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**Addressing Canine Separation Anxiety Using
Systematic Desensitization and Counter-conditioning**

A thesis

submitted in partial fulfilment

of the requirements

of

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at

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by

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Abstract

A canine's distress response to the owner's absence such as vocalisation, destruction and inappropriate elimination is a welfare issue, as ongoing occurrences of the behaviour can lead to a canine being relinquished, re-homed or euthanized. I aimed to identify if systematic desensitization or counter-conditioning were effective interventions at reducing separation-related behaviours when implemented individually without the support of additional behavioural techniques. Five canines that displayed separation-related behaviours were recruited for treatment. Video cameras were used to monitor the latency and frequency of separation-related behaviours for every absence during each condition. Each canine was randomly placed into either treatment Group A, applying systematic desensitization first then counter-conditioning, or Group B (applying counter-conditioning first then systematic desensitization). Treatment was changed if separation-related behaviours did not display evidence of reducing during the first treatment. Implementing systematic desensitization or counter-conditioning independently did not reduce or eliminate separation-related behaviours of canines as a long-term solution. Using a video camera to observe separation-related behaviours was beneficial for identifying if the owner-reported behaviours were occurring, as well as observing additional behaviours elicited by the owner's absence that did not produce evidence. In this research, owner compliance reduced during systematic desensitization which resulted in an increase in, or no change in separation-related behaviours. However, due to the fixed location of the video camera, separation-related behaviours may have been over- or under-reported during data collection. Further investigation into different

combinations of behavioural techniques that are effective and practical to apply for owners is suggested.

Keywords: Behaviour, Dog, Separation anxiety, Separation-related behaviour, Behavioural therapy, Systematic desensitization, Counter-conditioning

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Introduction

Separation Anxiety/Separation-Related Problem Behaviours

Separation anxiety is one of the most common behavioural problems of dogs, with 20-30% of canines displaying noticeable signs of separation anxiety sometime throughout their life, with estimated 40% displaying mild signs of distress when left alone (Mills, Dube, & Zuluch, 2013). Separation-related behaviours such as excessive vocalisation (barking, whining, or howling), destructive behaviours (chewing, digging, and scratching), and inappropriate elimination (urinating, defecating, or vomiting) are common complaints made by dog owners when the canine is isolated or denied access to their owner (Borchelt & Voith, 1982; Bradshaw, McPherson, Casey, & Larter, 2002; Flannigan & Dodman, 2001; Gaultier, Bonnafous, Bougrat, Lafont, & Pageat, 2005; Kim et al., 2010; Lund & Jørgensen, 1999; Palestrini, Minero, Cannas, Rossi, & Frank, 2010; Podberscek, Hsu, & Serpell, 1999). Behaviours are likely to occur within 30 minutes after the owner's departure (Blackwell, Casey, & Bradshaw, 2016; Takeuchi, Houpt, & Scarlett, 2000), with behaviours peaking during the first hour of the owner's departure (Lund & Jørgensen, 1999). Each canine exhibits different behaviours, intensities, or frequencies when isolated (Overall, 2013). These problematic behaviours can cause financial and emotional stress for owners and can place strain on the human-animal bond (King, T., Marston, & Bennett, 2009; Serpell, 1996; Sherman & Mills, 2008; Simpson et al., 2007), which can lead to the dog being re-homed, placed in an animal shelter, or euthanized (King, T. et al., 2009; Overall, 2013; Sherman & Mills, 2008). Previous research has found that behavioural characteristics are important for Australian owners, who stated that their ideal dog would not exhibit any behavioural problems such as destruction

and/or escaping behaviours (Marston, Bennett, & Coleman, 2005b), and if a canine was to exhibit problematic behaviours, owners are likely to relinquish their canine (King, T. et al., 2009). Wells and Hepper (2000) surveyed 556 owners who had recently adopted a canine from the largest animal shelter in Northern Ireland over a 12-month period. They found that 36 canines had been returned to the shelter and 68.3% of owners reported that their canine had exhibited an undesirable behaviour within the first month of being adopted, such as fearfulness (53.4%), destructiveness (24.5%) and excessive barking (11.3%) (Marston, Bennett, & Coleman, 2005a; Marston et al., 2005b). Previous authors have also suggested that owners are reluctant to inform shelters that their dog exhibits problematic behaviours when re-homing as it may affect future adoptions (Marston et al., 2005a; Wells & Hepper, 2000) as canines that do not meet criteria for re-homing can be euthanized (Houpt, K., Honig, & Reisner, 1996).

Terminology for undesirable behaviours that occur while a canine is isolated from human contact can vary between authors (Palestrini et al., 2010) and can be termed separation anxiety (SA) (Amat, Camps, Brech, & Manteca, 2014; Blackwell et al., 2016; Takeuchi et al., 2000), separation-related behaviour (SRB) (Blackwell et al., 2016; Butler, Sargisson, & Elliffe, 2011; Podberscek et al., 1999), home-alone problems (Bertilsson, 2016), or separation distress (Amat et al., 2014). Throughout my thesis I will refer to the occurrence of undesirable behaviours as separation-related behaviours (SRB) and I will not state that a canine has separation anxiety (SA) as no canine received a medical diagnosis of SA from a veterinarian.

Canine Ownership

Canines are owned in 28% of New Zealand (NZCAC, 2016) and 38% of Australian households (ACAC, 2016), with the majority of people acquiring a canine for companionship, findings which align with those of other researchers (Jagoe & Serpell, 1996; Kobelt, Hemsworth, Barnett, & Coleman, 2003). In New Zealand, dogs of a mixed breed are more commonly owned (39%) than purebred canines (36%); however, Australian owners are more likely to own purebred canines (52%) than mixed breeds (41%). Dog owners in New Zealand and Australia are more likely to source a canine from a breeder (39% and 36%), than from an animal shelter (12% New Zealand, 16% Australia) (Australia, 2016; New Zealand Companion Animal Council Inc, 2016). Since numerous canines are owned in New Zealand and Australian households, identifying an effective behavioural intervention would be beneficial for owners if SRB begin to occur, as providing owners with knowledge on how to decrease the behaviours could help reduce the rate of canines being re-homed, placed in a shelter, or euthanised, increasing the canine's welfare.

Behaviours Associated with Separation Anxiety

The majority of complaints to animal control centres are due to vocalising canines (Flint, 2012). For example, the Auckland City Council, New Zealand, received 2,091 complaints in regard to canine vocalisations over a 1-year period (Auckland City Council, 2008) with one Auckland animal control centre receiving an average of 204 barking complaints a month (Auckland City Council, 2009). Previous authors have discussed that SRB does not occur due to disobedience or boredom, but rather as a result of distress (Lund & Jørgensen, 1999; Voith & Borchelt, 1985) as SRB have been found to decrease as the owners' absence

increases (Lund & Jørgensen, 1999; Palestrini et al., 2010). Barking can occur in many circumstances, such as alerting owners that strangers are present, isolation distress, or due to the lack of attention (Lund & Jørgensen, 1999; Overall, 2013). Isolation distress can trigger a canine to engage in barking vocalisations (Lund & Jørgensen, 1999), as well as bouts of barking, described as sequential barking without audible inter-bark intervals (Taylor, Reby, & McComb, 2010). Barking that occurs due to isolation distress can be described as high pitched with fluctuations (Lund & Jørgensen, 1999), compared to barks warning of passers-by that are deeper and fluctuate in pitch (Overall, 2013). Howling vocalisations are long-distance communication signals used as an attempt to contact a human companion when isolated (Lund & Jørgensen, 1999; Overall, 2013; Petak, 2010; Sherman & Mills, 2008), and are commonly associated with destructive behaviours (Sherman & Mills, 2008).

Canines may engage in destructive behaviours due to over-activity, over-reaction to arousing stimuli, play, and fear (Overall, 2013). Destructive behaviours directed toward doors, windows, or floors, where the owner may leave the home, can suggest that the canine is experiencing distress when isolated, especially if these destructive behaviours directed towards exit points do not occur in the presence of the owner (Voith & Borchelt, 1985). Destructive behaviour has also been associated with inappropriate elimination, as Blackwell et al. (2016) reported that 12 canines displayed inappropriate elimination in conjunction with destructive behaviour.

Other behaviours that may also indicate distress but are less frequently reported due to a lack of evidence include panting, pacing, circling, and licking (Blackwell et al., 2016; Mills et al., 2013; Overall, 2013). Panting, pacing, and

trembling behaviours may also occur during the owner's departure routine, as the stimuli present during the owner's departure activity become associated with the owner's absence, eliciting the onset of SRB (Borchelt & Voith, 1982; Voith & Borchelt, 1985). However, with the under-reporting of these behaviours due to lack of evidence, the intensity of distress the canine is experiencing may be underestimated (Amat et al., 2014; Overall, 2013).

Departure stimuli (shoes, keys, jacket) are also suggested to be associated with the owner's absence eliciting SRB, as Storengen, Boge, Strøm, Løberg, and Lingaas (2014) found that of 215 canines diagnosed with SA, 71% exhibited behavioural signs of distress when their owners engaged in their departure routine, and Podberscek et al. (1999) reported that behaviours such as restlessness (84%), shaking/shivering (59%), and whining (59%) occurred during the owners departure routine.

Before assuming that a canine is engaging in SRB due to isolation, examining the canines behavioural history and/or conducting a medical examination can help determine the correct diagnosis, and an appropriate treatment plan (Landsberg & Araujo, 2005). For instance, inappropriate elimination is not only a behavioural sign of SA but can also indicate clinical conditions such as gastrointestinal problems (Landsberg & Araujo, 2005) and Canine Cognitive Dysfunction (CCD) (Heath, Barabas, & Craze, 2007; Landsberg & Araujo, 2005; Osella et al., 2007).

Video Cameras

Video cameras are beneficial for identifying additional behaviours such as pacing, panting and trembling that may not be reported by owners due to a lack of evidence, as well as confirming whether the canine is engaging in the suspected

SRB and also allowing for measurement of the intensity and frequency of the behaviours (Flint, 2012; Sargisson, 2014). In a study by Palestrini et al. (2010), of the 23 canines that were found to exhibit SRB, vocalisations (23%) were reported to occur more frequently than panting (14%), or destructive behaviours (6%), and also reported that vocalisation began a lot earlier than destruction, as vocalisation began after a mean latency of 3.25 min and destruction after 7.13 min (Palestrini et al., 2010). Monitoring behaviours reported by the owner or neighbour with a video camera also provides a better understanding on whether the vocalisations are directed towards approaching stimuli or due to isolation distress, as well as identifying if destruction is occurring due to over-activity or play behaviour (Flint, 2012; Overall, 2013; Storengen et al., 2014). Flint (2012) observed 107 canines via video and tape recordings who had prompted complaints from the neighbour or dog control officers about problem barking during the owners' absence. From the video and tape recordings, 43 canines were diagnosed with SA and 54 canines were identified as exhibiting territorial barking (Flint, 2012). By identifying what is eliciting the behavioural response with a video camera, researchers are provided a better understanding on how to appropriately treat the behaviours without making assumptions on a treatment based on the owner or neighbour reports.

Aetiology

Research investigating the aetiology of SA or SRB has been inconsistent (Sargisson, 2014), leaving the aetiology of SA unknown (Overall, 2013). Previous researchers have reported factors that may contribute to the aetiology of SA/SRB, such as the source of the canine, breed, sex, and living arrangements, and it has also been suggested that SRB may arise if a traumatic event occurs, for example,

being isolated in a room flooded with hot water (Borchelt & Voith, 1982; Butler et al., 2011; Lund & Jørgensen, 1999).

Source of Canine

SRB are less prevalent with dogs sourced from breeders, compared to those obtained from animal shelters or a pet shop (Blackwell et al., 2016; Borchelt & Voith, 1982; Flannigan & Dodman, 2001; McGreevy & Masters, 2008). In contrast, however, Palestrini et al. (2010) found no direct link between the 23 canines with SRB and the source of the canine. Likewise, findings from Bradshaw et al. (2002) did not suggest that canines acquired from a shelter are more likely to have SRB than canines sourced from a breeder.

Effect of Breed

Previous researchers have reported that mixed breed canines are more likely to exhibit SRB than purebred canines (Storengen et al., 2014; Takeuchi et al., 2000). Yet, Blackwell, Twells, Seawright, and Casey (2008) found no difference between breeds that exhibited SRB, or other behavioural problems (Chung, Park, Kwon, & Yeon, 2016).

Effect of Sex

Gender has been considered a predisposing factor of SA/SRB, as SRB are reported to occur predominantly among male dogs (Flannigan & Dodman, 2001; Herron, Lord, & Hussein, 2014; McGreevy & Masters, 2008; Storengen et al., 2014; Takeuchi et al., 2000). However, other researchers have found no sex difference in canines that have SA or exhibit other undesirable behaviours (Blackwell et al., 2008; Kobelt et al., 2003; Palestrini et al., 2010). Takeuchi et al. (2000) suggested that male dogs may be diagnosed with SA more frequently than

female dogs as they are sometimes larger in size, have louder vocalisations, and produce more destruction.

Effect of Routine Alternations and Traumatic Events

An owner returning to employment after a long-period of un-employment is suggested to contribute to the onset of SRB, as the canine is suddenly exposed to long periods of isolation after being exposed to periods of constant contact with the owner (Borchelt & Voith, 1982; Butler et al., 2011; Landsberg & Araujo, 2005). Flannigan and Dodman (2001) found that 16% of owners had altered their home life (e.g., divorce or change in work schedule) around the same time as the onset of the SRB, and 10% of dogs had experienced an environmental change, such as, moving house, or loss of a canine or human. Butler et al. (2011) and Borchelt and Voith (1982) both reported on the possibility that experiencing a traumatic event, such as being placed in an animal shelter, or being left in a hot car, could lead to the onset of SRB or exacerbated behaviours. As Butler et al. (2011) reported that one canine displayed intensified SRB after being isolated in a bathroom that flooded with hot water for eight hours, and another owner reported SRB occurring after leaving their dog in a hot car for four hours.

Hyper-Attachment

Attachment behaviours such as shadowing the owner, remaining in close proximity to the owner, or consistent touching from the dog to the owner have been suggested to be components of SA, rather than an individual behavioural problem (Appleby & Pluijmakers, 2004; Flannigan & Dodman, 2001). Hyper-attachment is said to develop in adulthood (Appleby & Pluijmakers, 2004) following periods of change, such as being re-homed, experiencing the loss of a

person, or the owner becoming frequently more absent from home (Mills et al., 2013).

Treatment

Managing initial signs of SA is crucial as symptoms can intensify if behaviours are left untreated (Sherman & Mills, 2008). To treat behavioural symptoms accurately, the present behaviours and previous history of the canine needs to be considered (Appleby & Pluijmakers, 2004). Flint (2012) surveyed 211 dog owners about what action they would likely take to decrease their canines' barking, and the majority of owners were likely to call a dog trainer (28%) or a behaviourist (26%) to reduce the vocalisations, whereas 10% of owners stated that they would re-home their dog and 7% would consider debarking.

Various treatments have been suggested to help decrease SRB, such as altering the environment, providing medication, applying behavioural therapy, obedience training, and punishment (Amat et al., 2014; Borchelt & Voith, 1982). Although disobedience is not a contributing factor to the onset of SRB, there is some evidence to suggest that obedience training can help to reduce the problematic behaviours with the use of sit-stay, and down-stay procedures (Borchelt & Voith, 1982); however, Borchelt and Voith (1982) mentioned that obedience training cannot be used when a dog exhibits severe SRB.

Punishment

Punishment and correction are suggested to decrease SRB if the owner awaits until the canine engages in a distress response, then inserts punishment while the canine engages in the behaviour (Borchelt & Voith, 1982; Voith & Borchelt, 1985), although applying punishment techniques such as verbal growling, shaking, and smacking (Arhant, Bubna-Littitz, Bartels, Futschik, &

Troxler, 2010) can create alternative undesirable behaviours (Borchelt & Voith, 1982). Problematic behaviours can also increase with the incorrect application of punishment techniques, as the canine may associate the punishment with a specific location, object, or person, which can exacerbate behaviours or produce new problematic behaviours (Blackwell et al., 2008; Borchelt & Voith, 1982). The incorrect timing of punishment can also increase stress symptoms (Schalke, Stichnoth, Ott, & Jones-Baade, 2007), leading to a reduction in the dog's welfare rather than improvement. Blackwell et al., (2008) surveyed 192 dog owners in the United Kingdom and found that 16% only used positive reinforcement techniques to train their dog, 12% used a combination of positive and negative reinforcement, 32% used a combination of positive reinforcement and positive punishment, and 40% used a combination of all categories. Owners who only used positive reinforcement techniques reported an average of 8.5 undesirable behaviours to be exhibited by their canine, when compared to owners who used positive and negative reinforcement training techniques who reported an average of 13.5. Punishment techniques can increase emotional dependency towards the owner, contributing to an increase in SA (Voith & Borchelt, 1985). Hiby, Rooney, and Bradshaw (2004) found similar results when they surveyed 326 dog owners, reporting that canines trained with positive reinforcement were significantly more obedient than those trained with punishment techniques, or a combination of both positive reinforcement and punishment techniques. They also reported that punishment was positively correlated with problematic behaviours, with 97% of owners reporting that their canine engaged in at least one problematic behaviour, such as, barking directed towards people, SRB, repetitive behaviours, fear behaviours, and aggression.

Psychopharmacological Treatment Used Simultaneously with Behavioural Treatments

Clomipramine (Clomicalm®) and Fluoxetine (Prozac®) are two pharmacological interventions that are sold to owners as the medication is said to help to manage symptoms of SA of canines (King, J. N. et al., 2000; Sargisson, 2014). Podberscek et al. (1999) implemented a pharmacological intervention in conjunction with behavioural modification techniques to canines who displayed SRB. Each dog was placed into one of three groups. Group A received a placebo, Group B received clomipramine at a dose of 0.5 to 1.0 mg/kg and Group C received 1.0 to 2.0 mg/kg of clomipramine. The effectiveness of the behavioural modification techniques was assessed in the placebo group and the results found that behavioural modification techniques are effective at reducing SRB when used independently of pharmaceuticals. Contrasting results were found by King, J. N. et al. (2000) who recruited 95 canines and randomly placed them into three treatment groups that are comparable to the study by Podberscek et al. (1999); “standard-dose” clomipramine (1 to <2mg/kg. PO, q. 12 h); “low-dose” clomipramine (0.5 to <1mg/kg. PO, q. 12 h) and placebo (PO, q. 12 h), all to be applied in conjunction with behavioural modification techniques. The results found that the “standard-dose” was effective at reducing the frequency and severity of destructive behaviours and inappropriate elimination, compared to those canines who only received behavioural modification techniques. Although it was suggested that clomipramine should be used with behavioural therapy to help increase improvement rates. The effects of Reconcile® chewable tablets were investigated by Simpson et al. (2007) who recruited 197 canines. The Reconcile® chewable tablets (a fluoxetine dosage of 1 to 2 mg/kg once daily for 56 days) were

given to 101 canines and 96 canines received a placebo, all dogs were exposed to behavioural modification techniques. Over 8 weeks of treatment, 42% of canines in the Reconcile® group improved within a week of treatment compared to 17% in the placebo group. Significantly reducing destruction, vocalisation inappropriate elimination, excessive licking, and shaking or shivering of dogs that received reconcile compared to those canines that received the placebo. However, side effects occurred more commonly in those canines treated with reconcile, as 32% of canines treated with Reconcile® lost 5% more body weight compared to 16% of canines in the placebo group.

Nevertheless, pharmaceuticals may not be a treatment option for some owners due to the expense of the drug, but also some owners do not desire to medicate their canine because of the sedation effects (Podberscek et al., 1999) and negative side effects that their canine could experience (Simpson et al., 2007). Furthermore, pharmaceuticals do not address the underlying problem of the behaviours but rather suppress the symptoms, whereas behavioural therapy allows SRB to decrease through behaviour modification.

Behavioural Advice

Researchers have investigated whether providing new owners with advice can prevent SRB. Blackwell et al. (2016) examined the behaviour of 176 canines adopted from the RSPCA, where owners were provided a pamphlet containing either preventative behavioural advice on how to decrease the risk of SRB for their newly adopted canine (treatment group), or information about vaccinations and worming (control group). After a 12-week follow up, 38% of canines in the control group were reported to display SRB in their new home, whereas only 22% of canines in the treatment group displayed SRB in their new home. However,

Blackwell et al. (2016) mentioned that self-reports from the owners may not have revealed the intensity of the behaviours and the poor compliance of owners from the treatment group may have affected the results, as not all treatment group owners abided by the advice provided.

Thomas (2018) also investigated the efficacy of behavioural advice on SRB by providing 297 owners of newly rehomed ex-racing greyhounds with either an email containing evidence-based information on how to prevent SRB (treatment group), or an email that welcomed them to the greyhound community, mentioning that the owners could contact their local Greyhounds as Pets (GAP) kennel manager if they have any concerns with their greyhound's behaviours, or if they would like more information (control group). To examine the effectiveness of the behavioural advice, each owner was sent a link to an online questionnaire via email every 1-,3-, and 6-months, enquiring about SRB. At the 1-month questionnaire owners in the treatment group reported higher accounts of SRB (62.2%) compared to owners in the control group (37.8%), and at the 6-month questionnaire, owner reports of SRB increased to 70.8% for the treatment group, whereas, only 29.2% of owners in the control group reported SRB. The behavioural advice provided to the owners in the treatment group was not effective at helping prevent SRB in newly adopted greyhounds, as canines in the treatment group were more likely to exhibit SRB at the 6-month post-adoption (70.8%) compared to canines in the control group (29.2%). Thomas (2018) reported that providing owners behavioural advice without teaching owners how to implement the techniques or without offering assistance to the owner could have affected the outcome of the behavioural advice provided and may not be effective at preventing SRB, as owners may not implement behavioural

techniques if they do not consider their canine to elicit a distress response during their absence.

Systematic Desensitization

Systematic desensitization is a behaviour-modification technique commonly used with humans to help decrease anxiety or phobia towards a particular stimulus by exposing the individual to initially mild versions of the aversive stimuli, and then gradually increasing the intensity of the stimulus (Butler et al., 2011). Systematic desensitisation can be applied to canines that engage in SRB by initially exposing the canine to small increments of the owner's absence and gradually increasing the length of absence until a preferred separation length has been reached without the canine exhibiting SRB (Borchelt & Voith, 1982; Butler et al., 2011; Sargisson, 2014). Initial exposure to the feared stimulus should be mild, so that no anxiety is elicited (Borchelt & Voith, 1982; Butler et al., 2011; Sargisson, 2014; Wilson & Davison, 1971), as exposure to long isolation periods too quickly may contribute to an increase in the canine's anxiety levels by sensitizing the canine to the owners absence (Overall, 2013). Systematic desensitisation helps to desensitise the canine to the owner's departure and as the absences are continuously applied generalisation occurs when the absence sessions are increased (Borchelt & Voith, 1982).

At the present time, I have found no research that examines the effectiveness of systematic desensitization as an independent treatment for SRB of canines, as systematic desensitization is commonly used in conjunction with multiple treatments, such as counter-conditioning, cessation of punishment, exercise, stay training, and negative punishment (Butler et al., 2011; Takeuchi et al., 2000).

Butler et al. (2011) incorporated systematic desensitisation in conjunction with counter-conditioning, stay training and exercise. Eight canines were recruited that engaged in SRB when the owner was absent. Each canine's behaviour was rated by their owner and an independent observer on a 4-step rating scale (1 = very good, 2 = good, 3 = bad, and 4 = very bad) and vocalisations were recorded on a tape recorder. The severity of destructive behaviour for Dogs 2, 4, 5, 6, and 7 reduced by 72, 53, 75, 61, 64, and 58%, with the severity of vocalisations decreasing by 59 and 63% for Dogs 3 and 5. Systematic desensitisation was implemented by all owners, but owner compliance was poor for counter-conditioning. Stay training and exercise were also not found to be attributable to the success in the reduction of SRB. Butler et al. (2011) concluded that the reduction in frequency and severity of SRB was attributable to systematic desensitisation. However, the efficacy of systematic desensitisation used independently of other behavioural techniques remains untested. Researching the independent effects of systematic desensitization would be beneficial at identifying whether it can reduce SRB without the support of other behavioural techniques.

Counter-Conditioning

Counter-conditioning alters behaviours through extinguishing the conditioned response by replacing it with a new response (Blackwell et al., 2016; Butler et al., 2011). To extinguish the conditioned response, a new response that is incompatible with anxiety is paired with the conditioned stimulus. By associating the incompatible response with the conditioned stimulus at the same time as the old conditioned response was elicited, the former conditioned response should become extinct (Martin & Pear, 2010). For example, this technique could be used

in the SA context providing a canine with a positive reinforcing food treat before the owner isolates the canine (Butler et al., 2011).

Counter-conditioning was found to decrease fear behaviours towards thunderstorms in a canine but was used simultaneously with systematic desensitisation (Tuber, Hothersall, & Voith, 1974). However, Butler et al. (2011) did not conclude that counter-conditioning was effective at reducing SRB as owners were non-compliant with the instructions. Takeuchi et al. (2000) reported that of 52 canines recruited, 69% of owners applied counter-conditioning compared to only 35% of owners who complied with the instruction of uncoupling cues. However, the authors could not assess the effect of each behavioural technique provided due to multiple techniques being applied. Therefore, it would be beneficial to investigate whether the independent effects of counter-conditioning can reduce or eliminate SRB.

Owner Compliance with Treatments

Owner compliance is likely to contribute to treatment-success rates. Previous researchers have found that owner compliance is poor when owners are advised to apply multiple behavioural techniques daily (Butler et al., 2011; Takeuchi et al., 2000). Takeuchi et al. (2000) reported that owners who were provided fewer than five instructions were more likely to report improvements in their dog's symptoms or elimination of unwanted behaviours compared to owners who were provided more than five instructions. Owners were more likely to comply with basic, once-a-day instructions, rather than an instruction that required the owner to apply a treatment multiple times a day. Owners were also more likely to comply with instructions such as no punishment, increased exercise, and providing a special toy for more than 1 month, and were less likely to comply

with desensitization and uncoupling of cues (Takeuchi et al., 2000). Contrasting results have been found by Butler et al. (2011), who reported that all eight owners in their study complied with the implementation of systematic desensitization but three owners were not consistent with applying the basic instructions such as stay training, counter-conditioning, or increased exercise. Although owners did not comply with the treatment instructions, the results of Butler et al.'s (2011) study showed that SRB continued to reduce, suggesting that providing owners with one or two behavioural techniques may help to increase owner compliance, which could then have an effect on the reduction of SRB, resulting in an improvement in the canine's welfare.

Researchers have reported a decline in owner compliance when owners are provided behavioural treatments, compared to a pharmacological intervention, suggesting that owner compliance declines overtime (Levine, Ramos, & Mills, 2007; Takeuchi et al., 2000). Owners' understanding of behavioural treatments may also differ due to a lack of professional skills (Blackwell et al., 2016; Herron et al., 2014), therefore, providing owners with professional help to implement the treatment should help to increase owner compliance and treatment constancy (Herron et al., 2014).

Aim and Rationale of Research

In this research, I aimed to identify whether dog owners' implementation of one intervention, systematic desensitization, or another, counter-conditioning, was sufficient to reduce or eliminate SRB. In order to determine the effectiveness of systematic desensitization or counter-conditioning as independent interventions, the relevant behaviours were observed via video camera and analysed throughout baseline, treatment and follow-up conditions, using various

measures. I hypothesized that systematic desensitization would be an effective treatment at reducing SRB.

Method

Subjects

I received human ethics approval from the University of Waikato School of Psychology Research and Ethics Committee (#18:04) and animal ethics approval from the University of Waikato Animal Ethics Committee (#1022). Once ethics approval was received, I recruited pet dogs via social media forums, newspaper articles, and flyers (Appendix A) distributed at veterinarian clinics within the Waikato Region and Rotorua, New Zealand, between March and August 2018. I offered each owner free treatment in exchange for their participation. I recruited canines of any breed, sex, size, and reproductive status to participate in my research. However, I excluded canines under the age of 7 months to eliminate the possibility of “puppy behaviours” such as teething, play behaviours, or inadequate house training, which could have confounded the analysis of SRB (Butler et al., 2011; Flint, 2012; Herron et al., 2014; Hiby et al., 2004; Houpt, K. A., 2018; Lund & Jørgensen, 1999; Voith & Borchelt, 1985). I also excluded all canines previously diagnosed with a medical illness, to minimize the possibility of a medical illness having an impact on the canine’s behaviours (Butler et al., 2011; Podberscek et al., 1999; Voith & Borchelt, 1985). Eighty-two owners interested in my research contacted me via email (Appendix B), but only 42 owners were invited to complete a screening questionnaire to determine if the canine met the criteria for recruitment presented in Table 1 (the *Subject Screening* process is described in more detail in the *Procedure* section, below). Of the 42 owners I interviewed, 30 reported behaviours that met my

inclusion criteria. Two owners did not respond to my email in regard to recruitment and three removed themselves before beginning baseline. Seven owners were put on a waitlist and three owners removed themselves from that waitlist without participating in the study.

Table 1

*Inclusion and Exclusion Criteria**Inclusion criteria*

1. Canine displays one or more of the following behaviours when left alone:
 - a. Excessive vocalisation
 - b. Destructive behaviour
 - c. Inappropriate defecation in the house (for a house-trained canine)
 - d. Inappropriate urination in the house (for a house-trained canine)
2. Vocalisation needs to be:
 - a. Barking
 - b. Whining
 - c. Howling
3. Destructive behaviours occur in one or more of the following locations:
 - a. Door frames
 - b. Curtains
 - c. Carpet/linoleum
 - d. Kennel door/walls
 - e. Furniture
4. Inappropriate urination or defecation occurs:
 - a. If the canine is house-trained
 - b. By an exit to where the owner leaves the house

Exclusion criteria

1. Excessive vocalisation occurs in the presence of the owner.
2. Destructive behaviours occur in the presence of the owner.
3. Vocalisation behaviours only occur in response to stimuli in the canine's environment, such as strangers walking past the house, other animals, or people at the door.
4. The canine is younger than 7 months.
5. A medical condition is present that may affect the behaviours or alter the results

Overall, 18 owners participated in baseline. I removed seven canines from the baseline phase (see section *Conditions and Design*, below) as they did not display the behaviours reported by their owners. Two further canines were removed as their behaviours reduced steadily during baseline and one other

because of alterations to their medication. Three owners removed themselves before beginning the baseline phase, and three owners withdrew from treatment as they could not commit to the intervention.

My final sample was five dogs and their owners. A summary of the subjects' characteristics and behaviours are in Table 2.

Table 2

Summary of Subjects Characteristics and Behaviours

Dog	Breed	Age (mth)	Sex	Age acquired (mth)	Problem Behaviours	Source
1	Bichon X toy poodle	c. 108	M	18	Vocalisation Destruction Panting Trembling	Re-homed
2	English cocker spaniel	75	M	2	Vocalisation Trembling	Family member
3	Pitbull X whippet	42	F	2	Vocalisation	Re-homed
4	Labrador X border collie	53	F	2	Destruction	Re-homed
5	German shorthaired pointer	40	M	3	Vocalisation Trembling	Breeder

I selected dogs in order of severity of the problem behaviour that occurred during the owner's absence, as the distress elicited by the owner's absence was a safety risk for the dog and a potential disturbance to the neighbours that may have resulted in the council removing the canine. If the canine was not observed to display any SRB during baseline, I removed the canine from my research and recruited the next canine on my waitlist.

Dogs 2, 4 and 5 were isolated outside during the owners' absence, Dog 3 was kept inside, and Dog 1 was confined in a crate. Dogs 1 and 4 were isolated for 2-4 hours per day, Dogs 2 and 5 were isolated for 8-9 hours per day and Dog 3

was never left alone. Four out of five owners reported that their dog was extremely needy when they were home and one owner reported that their dog was moderately needy. Vocalisation was the most common problem behaviour reported by owners, followed by trembling, destruction, and panting. None of the dogs displayed inappropriate elimination.

Equipment

Before baseline began, I provided each owner with a Panasonic HC-V160 high definition video camera powered by a 5.0/3.6 V battery capable of recording for a maximum length of 343 min. The video camera was placed in a suitable area chosen by the owner that would capture the majority of the canine's behaviours. The owners were also provided with a 32 GB SD memory card.

I supplied each owner with two food treats for each counter-conditioning session conducted. The type of treats differed, depending on the dog's preferences as reported by their owners. If the owner was unsure of a food treat that was likely to be reinforcing, I completed a short preference test with the canine. For this preference test, I placed two treats in front of the dog, the treat eaten first was the treat provided for counter-conditioning.

I used Beats Solo3 Wireless noise-cancelling headphones during video data analysis.

Procedure

Subject Screening

I responded to all owners who emailed me in response to my recruitment advertisements, and I requested additional information from owners who did not specify which behaviours were exhibited by their dog. I informed each owner who declared that their canine did not display vocalisation, destruction, or

inappropriate elimination during their absence that their dog did not meet the criteria for my research (Table 1).

I invited owners who reported that their dog displayed vocalisation, destruction, or inappropriate elimination while the owner was absent to participate in a screening interview (Appendix C) via telephone or in-person. The screening interview contained 20 questions adapted from Herron et al. (2014) and King, J. N. et al. (2000). I included four main topics to assess the history of the canine and the current behaviours; when the owner leaves the canine alone, what behaviour(s) occurs while the owner is absent, whether unwanted behaviour(s) also occurs while the owner is present, and whether the canine becomes distressed when the owner is preparing to leave home. I phoned each owner to advise them whether their canine had met criteria and notified the owner if they were recruited for the first intake or placed on the waiting list. I gave each owner the option to decline involvement in my research.

Baseline

Before the baseline condition began, I provided each owner with an information form and asked each owner to sign a consent form (Appendix D) agreeing to take part in my research. Owners were informed that if SRB were not present during the baseline phase that their canine would be removed from my research. I supplied the owners with the recording equipment and a 1-page handout explaining its use and how to name and upload the videos to Google Drive or Dropbox for me to access (Appendix E).

For the baseline data collection, I instructed each owner to record their canine during three absences for a minimum of 1 hour in the environment where the canine was kept during the owner's absence. The owners were asked to

engage in their normal departure routine and to turn on the video camera before they left their home for each absence session.

I watched each video recording for baseline to ensure that the owners absence elicited SRB and that SRB were stable or increasing in frequency over the three baseline observations before treatment begun. If SRB declined in frequency during baseline, another video recording was requested. A further reduction in SRB during baseline resulted in the canine being removed. I randomly placed each canine into treatment Group A or B by mixing the recruitment files and placing the first canine in Group A, the second canine in Group B, and so on. If an owner was removed from baseline or treatment, the next recruited dog was placed in the group the canine was removed from. A second baseline condition was requested for Dog 2 before the second intervention was implemented due to the time gap since the last treatment application and the beginning of the second intervention.

Treatment

I randomly placed Dogs 3 and 5 into Group A, and Dogs 1, 2 and 4 into Group B. I instructed Group A to implement systematic desensitization first and if SRB were not seen to decrease over five consecutive treatment days, counter-conditioning was then implemented. I instructed Group B to implement counter-conditioning first and if SRB were not seen to decrease over three consecutive sessions, systematic desensitization was then implemented. Different ending criteria was used due to the design and intention of each intervention. I maintained consistent communication with the owner throughout the treatment condition and advised owners to contact me if they had any questions or if they could not complete the treatment plan over a period of days.

Systematic Desensitization

Systematic desensitization was implemented by the owner; however, each owner was provided my assistance to determine the absence length for each session, except for Dog 5, as I applied the systematic desensitization absences.

I instructed each owner to implement the absence sessions 4-6 times a day with a 1-hour break between each absence, and to record each absence session (Butler et al., 2011; Appendix F). However, for owners of Dogs 2 and 5, having a 1-hour break between each absence was not possible as the owners worked in full-time employment, so I advised these owners to complete half the absences in the morning before leaving for work and then complete the other half of the absences in the afternoon.

I instructed each owner to engage in their normal departure activities when leaving their dog during an absence session, such as grabbing their keys and handbag, putting shoes on, and locking the door (Borchelt & Voith, 1982). I advised all owners to avoid punishment if their canine engaged in SRB during their absence. I also encouraged owners to avoid prolonged absences outside of the treatment period while implementing systematic desensitisation, and advised owners to source an alternative location for their canine if they needed to leave their canine outside of the absence sessions (Blackwell et al., 2016; Butler et al., 2011), such as doggy day-care, a dog sitter, a friend, family member, or myself. If an alternative location could not be sourced, I instructed owners to record the canine during the absence (Echterling-Savage, DiGennaro Reed, Miller, & Savage, 2015).

I provided each owner with an initial absence length based on their canine's average baseline latency (measured as the time from the owner's absence

to the first occurrence of SRB). If the canine began the intervention with an absence session that was less than 5 min, I instructed the owner to increase the absence sessions by 10-30 s until an absence length of 5 min was reached with no evidence of SRB. I then instructed the owner to increase the absence length by 5-min increments. Once an absence of 30 min was reached without the canine exhibiting SRB, I instructed owners to increase their absence length by 10-min increments until 60-min was reached, or until the ideal absence time for the owner was reached. I instructed the owner to increase the absence length when the canine displayed no SRB over three consecutive absences, and if any SRB were elicited during an absence session, I instructed the owner to apply the previous absence length that did not elicit any SRB.

If SRB reduced during systematic desensitization, the treatment continued until the owner's ideal absence length was reached without the owner's absence eliciting SRB. If the absence lengths were not increasing after 5 days, I instructed the owners in Group A to begin counter-conditioning. Owners in Group B implemented counter-conditioning before systematic desensitization, therefore, if systematic desensitization was not effective at reducing SRB after 5 days for Group B, I instructed the owner to stop implementing systematic desensitization and informed the owner that their participation in my research had ended and thanked the owner for their participation.

Counter-Conditioning

I adapted the counter-conditioning instructions from Butler et al. (2011) and Blackwell et al. (2016; Appendix G). I instructed each owner to deliver a food treat 5 min before they left their property and immediately before departing from their dog. I instructed each owner to follow the counter-conditioning instructions

each time they intended to leave their canine. If the owner did not leave their home on a regular basis, I requested that the owner complete counter-conditioning once a day for a minimum absence of 60 min. I also advised all owners to refrain from punishing their dog during treatment.

If there was a reduction in SRB during treatment, I instructed owners to continue the intervention until the canine did not display any behaviours over eight consecutive absences. However, if SRB were not reducing compared to baseline over three absences, then I instructed owners to stop counter-conditioning. If SRB were variable over multiple days with no steady declining trend, counter-conditioning was discontinued. Owners in Group A implemented systematic desensitization before counter-conditioning, therefore, if counter-conditioning was not effective at reducing SRB after 3 days for Group A, I advised the owner that treatment was concluded, and I thanked the owner for their participation. If the canine was in Group B, I instructed the owner to apply systematic desensitization.

Follow-Up

Once treatment was finished, I asked all owners to record their canine for three absences for a minimum of 60-min, 14 days after the last treatment day in the same environment where baseline was recorded. I asked owners to continue engaging in their normal departure routine and to turn on the video camera before they left their home for each absence session. I watched each video collected from the follow-up condition to observe the changes in behaviour compared to baseline and treatment.

Data Collection

A Microsoft Excel® 2016 spreadsheet was used to record the information of each owner and their dog interested in participating in my research. The information included whether the canine met criteria, location, and order of recruitment for treatment. All videos were dated and labelled. All the data collected were placed into Microsoft Excel® 2016 spreadsheet, where the graphs were also generated. Each behavioural measure of SRB; percentage of behaviour occurrence, latency, and frequency, was placed in a line graph to identify behavioural trends by visual analysis. The data I collected were not suitable for a statistical test to be completed due to the small sample size.

Design and Data Analysis

I adopted a single-subject, multiple-treatment, design. I analysed the behaviour recorded on each video file on 2016 MacBook Air. All videos were watched at normal speed, except for Dog 4 whose videos were watched on 2x-speed setting as the destructive behaviours occurred at a low frequency. I watched all videos three times and each video was paused and re-watched where necessary during data collection. I used different sampling methods for each dog. The operational definitions (Table 3) were adapted from definitions previously used in similar studies and were matched against the SRB presented in the baseline videos from Dogs 1 and 3 to ensure the operational definitions corresponded with the present behaviour (Butler et al., 2011; Flint, 2012; Levine et al., 2007; Lund & Jørgensen, 1999; Palestrini et al., 2010; Yin & McCowan, 2004).

For Dog 1, I measured vocalisations and panting behaviours using an interval recording sampling method, measuring the presence of vocalisation and panting during the first 15 s of every min of the first 60 min after the owner's

absence. For Dog 1's destructive behaviours, I measured the presence of destruction during the first 20 s of every minute of the first 60 min after the owner's absence. For Dog 2, I measured the presence of vocalisations using an interval recording sampling method, measuring the first 15 s of every minute of the first 31 min after the owner's absence. For Dog 3, I measured the presence of vocalisations using an interval recording sampling method, where I sampled the first 15 s of every min of the first 60 min after the owner's absence. Additionally, I labelled and measured low-magnitude vocalisations which is equivalent to heavy breathing integrated with a subtle whine on exhale (Table 3). To measure the number of vocalisations that occurred within a session length, I transferred the video into a programme called 'Audacity' that produced sonograms of the vocalisations. Sonograms of the vocalisations were used to record the number of vocalisations that were exhibited during an absence session, as seen in Figure 1. A sonogram of a low-magnitude vocalisation exhibited by Dog 3 is displayed in Figure 2. Other vocalisations exhibited by Dog 3 included a whine that transitioned into a howl or a howl that transitioned into a whine, these vocalisations are also displayed in Figure 2. The low-magnitude vocalisations were also measured during the interval recording sampling method, but the percentage of the low-magnitude vocalisations were recorded independently on Figure 9, as well as in the total vocalisation percentage. In addition, I recorded latency for each dog, measuring from the beginning of the owner's absence to the onset of the first behaviour occurrence.

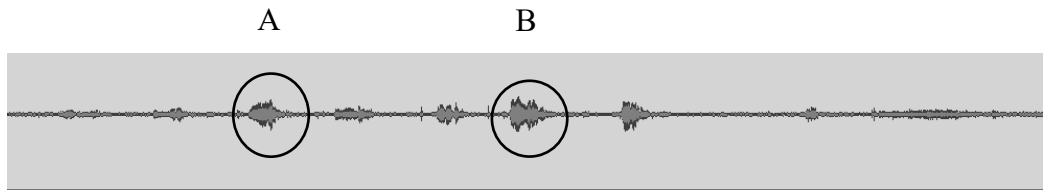


Figure 1. Vocalisations from Dog 2 presented on a sonogram from ‘Audacity’. A and B present two separate vocalisations

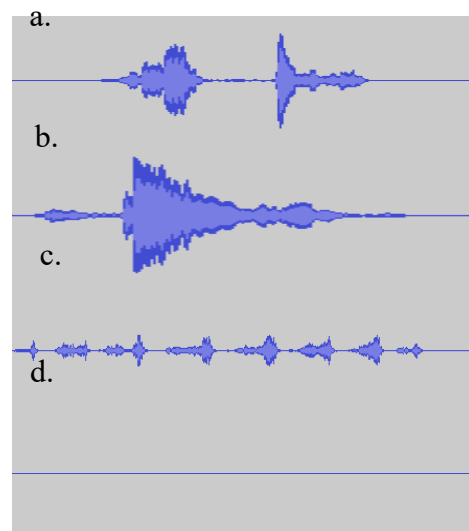


Figure 2. Four types of vocalisations exhibited by Dog 3; a) howling and whining together b) a whine and howl together, c), consistent whining and d) a low-magnitude vocalisation which resembled heavy breathing.

For Dog 5, I calculated the number of vocalisations that occurred within a 1500-s absence for baseline and follow-up conditions, and for the systematic desensitization absences I measured and reported the number of vocalisations per 1500-s. I measured the frequency of destruction for Dog 4 differently due to the difference in absence length, measuring the number of destructive occurrences during the owner’s 60-min absence. Trembling and pacing were not analysed, as accurate measurements of the behaviours could not be recorded due to the location of the camera and lack of equipment required. If external stimuli were observed to elicit a vocalisation response, that vocalisation was not included in the data collection or if it was later discovered that a person was home during observation but did not present themselves, the entire video was not included in the research, as it was crucial that the canine was home alone.

Table 3

Operational Definitions of Behaviour

Category	Definition
Absence	Isolating the dog and removal of all human presence, eliminating access from the dog to owner. For baseline, counter-conditioning, and follow-up observations; removal of human presence from the property. The owner is not to wait outside the front door, in the garage, or by the letter box.
Vocalisation	Barking, whining, and howling (Butler et al., 2011; Lund & Jørgensen, 1999).
Low-magnitude vocalisation	Heavy breathing integrated with a subtle whine on exhale.
Panting	The mouth is open with tongue showing, heavy breathing may also occur (Levine et al., 2007).
Destruction	Vigorous behaviour directed toward objects or crate by using the mouth (Palestrini et al., 2010). The vigorous behaviour towards the item or crate results in objects (furniture, clothes, curtains, carpets) being torn or chewed (Lund & Jørgensen, 1999). Active behaviours that result in physical contact of the paw with the cage/door or other specific objects in the home (Lund & Jørgensen, 1999; Palestrini et al., 2010).
Trembling	Trembling or shaking movements of the body or head (Palestrini et al., 2010).
Elimination	Urinating or defecating in sitting or standing position (Lund & Jørgensen, 1999; Palestrini et al., 2010).
Play behaviour	Jumping throwing toys, pawing at objects that may also be accompanied by intermittent and medium to high-pitched barking with a relaxed wagging tail (Flint, 2012; Yin & McCowan, 2004).
Pacing	Walking behaviour that occurs more than three times consistently in the same area (Levine et al., 2007). Walking or running around without exploring the environment (Palestrini et al., 2010).

Inter-Observer Reliability

A PhD student in behaviour analysis at the University of Waikato completed the inter-observer rating on 10% of each dog's data. Before she analysed the videos, I provided examples of what qualified as vocalisation, destruction, and panting for each canine (Table 3), as well as examples of behaviour that did not qualify.

For interval sampling, we noted whether a behaviour occurred in each of the 60-time samples, I then divided the number of agreements by the number of time samples to receive the percentage of agreement. For example, 56 agreements divided-by 60-time samples = 93.33%. I then added each percentage from each absence session and divided the total by the number of absence sessions, to get the total agreement percentage.

For latency, both observers measured the length of time from the owner's absence to the reaction time for each session. I calculated the percentage of agreement from the owner's absence to the first measured occurrence of behaviour between the two observers for each session, I then added each percentage from each absence session and divided the total by the number of absence sessions, to get the total agreement percentage. If both observers disagreed by 0.1-0.2 s, the latency time was still measured as a 100% agreement, as the start of the absence or behaviour onset was occurring at that point in time.

For frequency, I measured the percentage of agreement between the two observers for each absence session, I then added each percentage from each absence session and divided the total by the number of absence sessions, to get the total agreement percentage.

Compliance

I instructed owners to implement the absence sessions daily. If the owner did not apply the absence sessions after two days, I contacted the owner to ask if they required any assistance with implementing the treatment.

I measured owner compliance by measuring the number of days systematic desensitization was implemented and the number of absence sessions completed each day. A line was plotted on the graph using least-squares linear regression to identify via visual analysis whether the owner reduced the number of absence sessions applied per day as the treatment progressed.

Results**Dog 1**

Dog 1 engaged in vocalisation, destruction, and panting during the owner's absence which I measured using interval sampling and latency.

Interval Sampling

Figure 3 displays the percentage of intervals in which Dog 1 exhibited vocalisation and panting. To generate the data points, I used an interval-sampling method, sampling the first 15 s of every min for 60 time samples after the owner's absence, except for Session 95 where I sampled 43. Figure 3 also displays the percentage of intervals in which Dog 1 exhibited destruction, I used an interval-sampling method, sampling the first 20 s of every min for 60 time samples after the owner's absence.

Vocalisation

The percentage of intervals with vocalisations slightly increased over the three baseline observations, see Figure 3. During the first two counter-conditioning sessions, frequency of vocalisation did not change and although

there was a slight reduction in the percentage during counter-conditioning, the percentage then increased back to baseline levels. The systematic desensitization absences were not measured using an interval sampling method and are therefore not displayed in Figure 3. During the first systematic desensitization probe session (Session 35) the frequency for vocalisation decreased, but as systematic desensitization continued, the percentage of intervals with vocalisations continued to increase, returning to baseline levels, where it remained at follow-up.

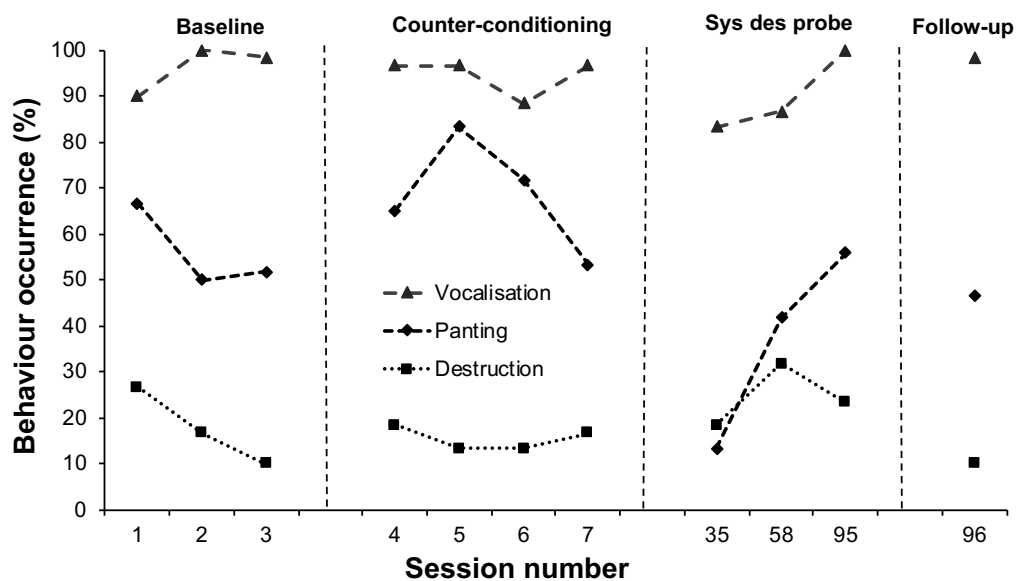


Figure 3. Percentage of intervals with vocalisations (triangles), destruction (squares), and panting (diamonds) exhibited by Dog 1 over baseline, counter-conditioning, systematic desensitization, and follow-up conditions.

Destruction

Destructive behaviour was exhibited less frequently by Dog 1 than vocalisation, as destructive behaviour was occurring at an average of 17.7% over the three baseline observations (Figure 3). Counter-conditioning did not change the frequency of destructive behaviour as the percentage remained consistent, matching baseline levels. No reductions in percentage were displayed during systematic desensitization, but rather an increase in the percentage of intervals with destructive behaviours before returning to baseline levels for Session 95. The

follow-up observation displayed no change in frequency when compared to baseline levels.

Panting

Figure 3 shows that the percentage of intervals with panting declined before stabilising during baseline. The percentage of intervals with panting then suddenly increased during counter-conditioning before a gradual decline back to baseline levels as the counter-conditioning sessions continued. During the first systematic desensitization probe, the frequency of panting drastically reduced but as systematic desensitization continued, panting progressively increased back to baseline levels. The percentage of intervals with panting slightly reduced below baseline levels during the follow-up observations.

Latency

Reductions in latency signify the onset of SRB occurring closer to the owner's absence and increases in latency signify the onset of SRB improving. The absence of behaviour ("no behaviour") signifies that the length of separation did not elicit SRB.

Vocalisation

As displayed in Figure 4, latency to vocalisation rapidly changed over the three baseline observations. This sudden decrease in latency during Session 2 suggests that an event or stimulus during departure may have caused the SRB to occur faster. Counter-conditioning did not change the latency to vocalisation, showing the same rapidly changing latency lengths presented in baseline. The initial systematic desensitization absences did not increase the latency length, but as the treatment progressed, the session length gradually increased as no vocalisations were detected. Latency to vocalisation then suddenly increased

above baseline levels during the first systematic desensitization probe session (Session 35), but this change in latency did not occur again. As the treatment continued, the session length increased even though vocalisations began to occur almost immediately after the owner's absence, returning to baseline levels, where it remained at follow-up.

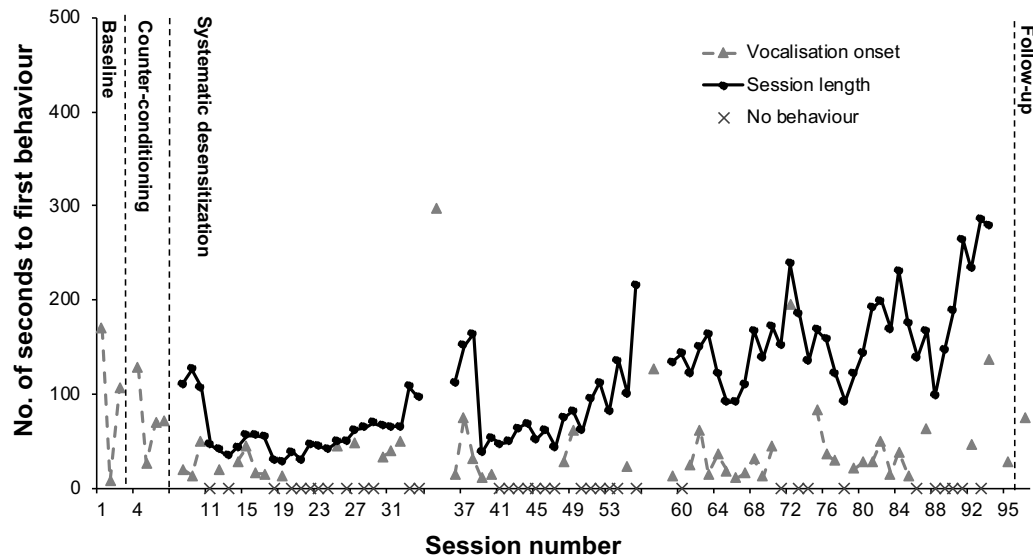


Figure 4. The time from the owner's absence to the first vocalisation, for baseline, counter-conditioning, systematic desensitization, and follow-up conditions for Dog 1. Session length was 3600 s for baseline, counter-conditioning and follow-up conditions, except for Session 95 which had a session length of 2580 s but is not displayed on Figure 4 for those conditions.

Destruction

As displayed in Figure 5, latency to destruction suddenly decreased during baseline before rapidly increasing. This sudden decrease during Session 2 suggests that an event or stimulus during departure may have elicited the SRB to occur faster. Latency increased above baseline levels for the first counter-conditioning session but as treatment continued latency quickly declined, returning to baseline levels. During initial applications of systematic desensitization, no destructive behaviours were detected which resulted in an increase in session length. After exposure to 34 systematic desensitization absence

sessions, latency for destruction suddenly increased above baseline levels during the first systematic desensitization probe session (Session 35). However, as the treatment progressed, latency to destruction gradually decreased as SRB began to occur more frequently during the absence sessions, therefore returning to baseline levels, where it remained for follow-up.

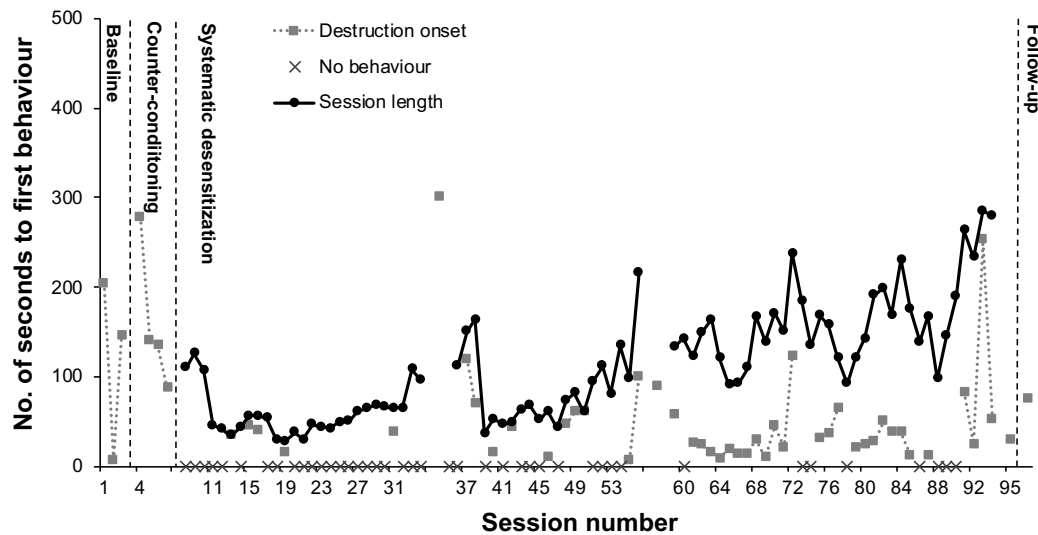


Figure 5. The time from the owner's absence to the first destructive behaviour, for baseline, counter-conditioning, systematic desensitization, and follow-up conditions for Dog 1. Session length was 3600 s for baseline, counter-conditioning and follow-up conditions, except for Session 95 which had a session length of 2580 s but is not displayed on Figure 5 for those conditions.

Panting

Figure 6 shows that latency to panting increased during baseline, and the length of latency reduced during counter-conditioning but still remained within baseline levels. Panting was not elicited during the systematic desensitization absence sessions due to the short session lengths. The latency to panting rapidly increased above baseline levels during the first systematic desensitization probe session (Session 35), but as the treatment progressed, latency to panting progressively decreased, returning to baseline levels during the last systematic

desensitization probe (Session 95). However, latency to panting slightly increased above baseline levels during the follow-up observation.

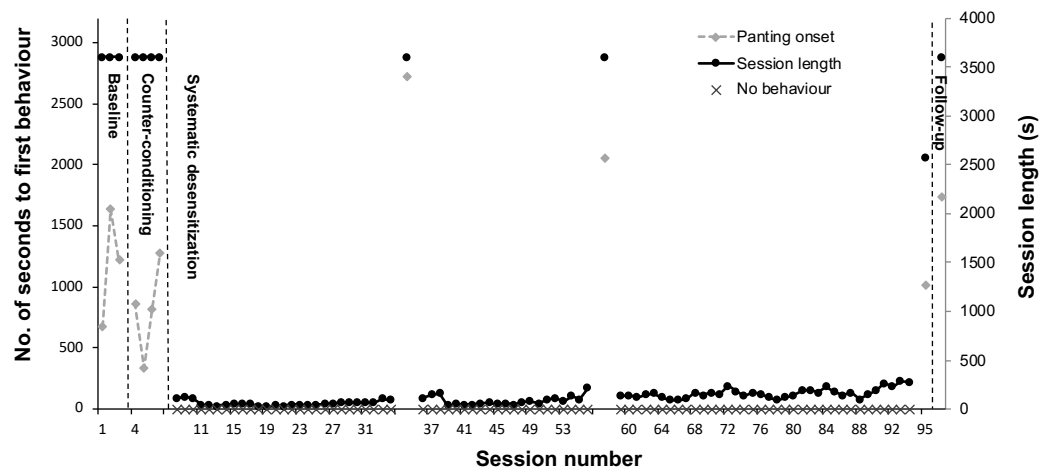


Figure 6. The time from the owner's absence to the first occurrence of panting, for baseline, counter-conditioning, systematic desensitization and follow-up conditions for Dog 1.

Dog 2

Dog 2 engaged in vocalisation during the owner's absence which I measured using interval sampling and latency.

Interval Sampling

Figure 7 displays the percentage of intervals in which Dog 2 exhibited vocalisations. To generate the data points, I used an interval-sampling method, sampling the first 15 s of every min for 31 time samples after the owner's absence. Systematic desensitization probe sessions are not displayed on Figure 6, as no probe sessions were recorded for Dog 2.

Vocalisation

As shown on Figure 7, the percentage of intervals with vocalisations varied during baseline, peaking in Session 3. The first counter-conditioning application produced an increase in the frequency of vocalisation above baseline and as treatment progressed the frequency of vocalisations fluctuated

considerably, peaking at Session 11. The level during the second baseline observations resembled the initial baseline level. The percentage of intervals with vocalisations initially decreased below baseline levels during follow-up before gradually increasing back to baseline levels.

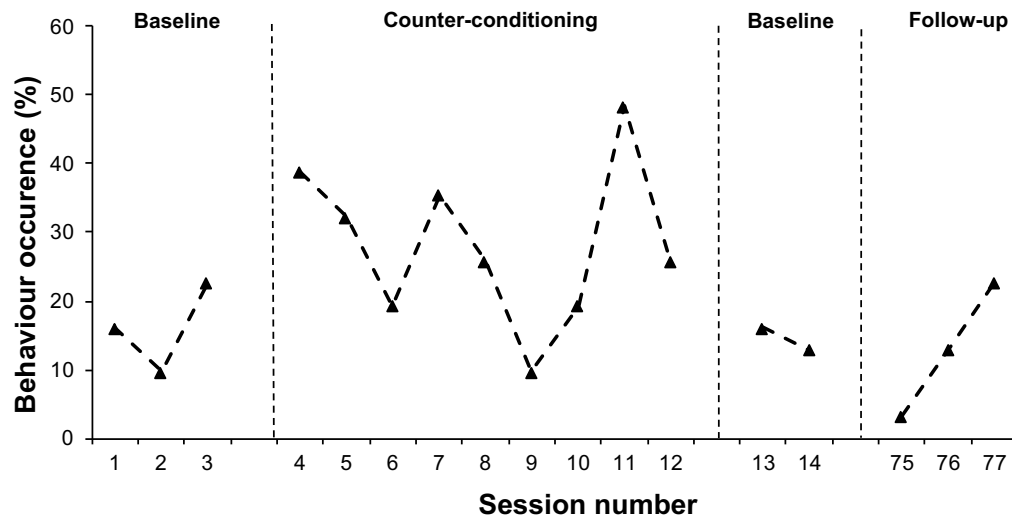


Figure 7. Percentage of intervals with vocalisations exhibited by Dog 2, over baseline, counter-conditioning, and follow-up conditions.

Latency

Latency for Dog 2 was analysed using the same measures as Dog 1.

Vocalisation

As displayed in Figure 8, latency to vocalisation was low during baseline, with the onset of the first vocalisation occurring almost immediately during Sessions 2 and 3. Latency substantially increased during counter-conditioning but between the nine counter-conditioning sessions, it fluctuated considerably before a sudden increase during the last counter-conditioning application. The level of the second baseline resembles the initial baseline levels. Initial applications of systematic desensitization elicited an early onset of vocalisations resembling similar baseline latencies, but as the absence sessions continued there was no change in the session length as latency fluctuated between no occurrence of SRB

and reduced latency lengths that resembled baseline levels at the end of the treatment. During follow-up, latency increased considerably but then returned to baseline levels.

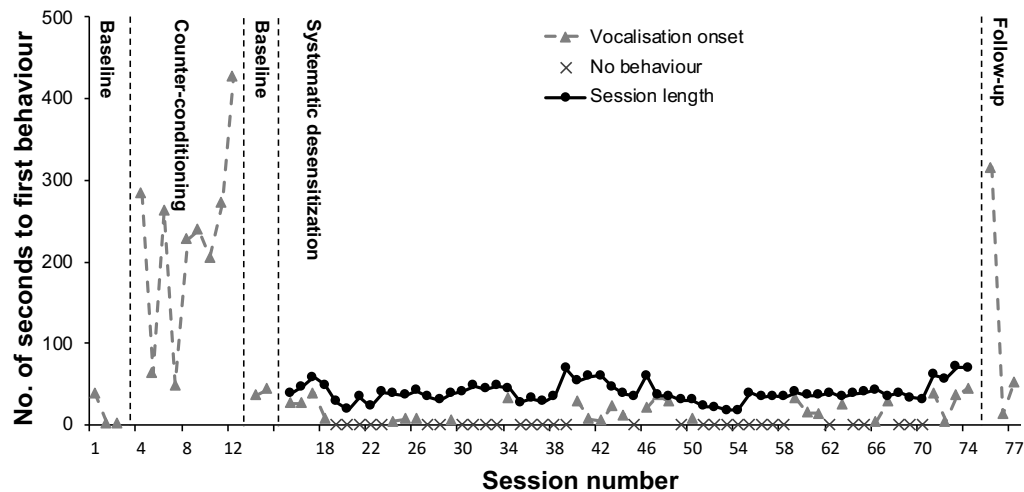


Figure 8. The time from the owner's absence to the first vocalisation, for baseline, counter-conditioning, systematic desensitization, and follow-up conditions for Dog 2. Session length was 1860 s for baseline, counter-conditioning and follow-up conditions but is not displayed on Figure 8 for those conditions.

Dog 3

Dog 3 engaged in vocalisation during the owner's absence which I measured using interval sampling and latency. Different types of vocalisations were exhibited during the owner's absence such as whining, howling, and low-magnitude vocalisations (Figure 2). A low-magnitude vocalisation is presented as a flat line on the sonogram (Figure 2) as the programme 'Audacity' did not receive the sound produced by Dog 3 due to low sound of the vocalisation. The sound of the low-magnitude vocalisation was diverse to a whine or howl but was rather equivalent to heavy breathing integrated with a subtle whine on exhale. The presence of low magnitude vocalisations was included within the total vocalisation percentage and the total number of low-magnitude vocalisations

exhibited by Dog 3 in the intervals is presented on its own data point to display a reduction in vocalisation intensity.

Interval Sampling

Figure 9 displays the percentage of intervals in which Dog 3 exhibited vocalisation and low-magnitude vocalisations. To generate the data points, I used an interval-sampling method, sampling the first 15 s of every min for 60 time samples after the owner's absence. Systematic desensitization probe sessions are not displayed in Figure 9, as no probe sessions were recorded for Dog 3.

Vocalisation

Figure 9 shows that the percentage of intervals with vocalisations increased at a steady rate over the three baseline observations, while the percentage of intervals with low-magnitude vocalisations remained low. The frequency of vocalisation slightly reduced during counter-conditioning but returned to baseline levels during the last session of counter-conditioning. Although there was a reduction in the percentage of vocalisations during Session 102, the percentage of intervals with low magnitude vocalisations rapidly increased before returning to baseline levels. In the follow-up observations, the percentage of intervals with vocalisations declined substantially 14 days after the last counter-conditioning session and although the frequency of vocalisation increased, the level remained below baseline. The percentage of the low magnitude vocalisations also increased during follow-up, indicating that although

the frequency of vocalisation was high the vocalisations exhibited by Dog 3 were of low intensity.

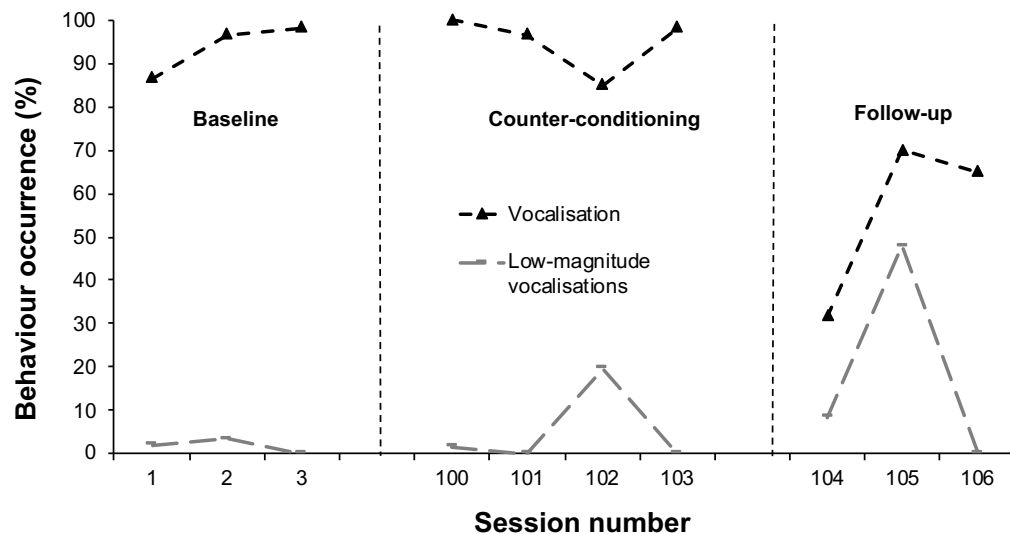


Figure 9. Percentage of intervals with vocalisations exhibited by Dog 3, over baseline, counter-conditioning and follow-up conditions, for all vocalisations as well as the percentage of intervals with low-magnitude vocalisations.

Latency

Latency for Dog 3 was analysed using the same measures as Dog 1.

Vocalisation

Figure 10 shows a substantial reduction in latency over the three baseline observations. The session length fluctuated during the beginning of systematic desensitization, which resulted in the latency to vocalisation to decrease. But as the treatment progressed, no vocalisations were elicited during the absence sessions resulting in an increase in latency while also displaying a steady upward trend in session length. However, at the end of systematic desensitization, vocalisations began to reoccur and returned to baseline levels. Counter-conditioning did not have an effect on latency, as similar latencies at the end of systematic desensitization were observed. The follow-up latencies remained within baseline levels and displayed a similar declining trend as in baseline.

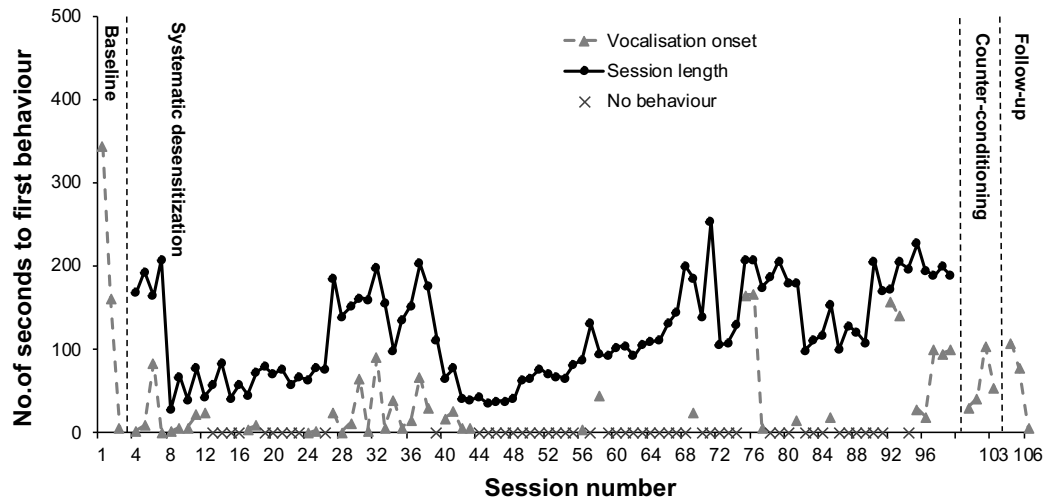


Figure 10. The time from the owner's absence to the first vocalisations for baseline, systematic desensitization, counter-conditioning and follow-up conditions for Dog 3. Session length is 3600 s for baseline, counter-conditioning and follow-up conditions but is not displayed on Figure 10 for those conditions.

Dog 4

Dog 4 engaged in destruction during the owner's absence which I measured using latency and frequency. Dog 4 was not exposed to systematic desensitization.

Frequency

To generate the data points for frequency, I calculated the total number of destructive behaviours that occurred within a 3600 s absence.

Destruction

Figure 11 shows that the frequency of destruction fluctuated over the six baseline observations, with initial counter-conditioning sessions resembling a similar fluctuating trend. But as counter-conditioning continued, the frequency of destructive behaviours reduced until the behaviours were eliminated. Destructive behaviours remained absent during the first two follow-up observations, but then returned to baseline levels after a sudden increase in frequency. Alongside the reduction in frequency, the severity of the destruction produced also reduced, as

Figures 12 and 13 display the damage produced on Session 1 compared with the same damaged item 77 days later.

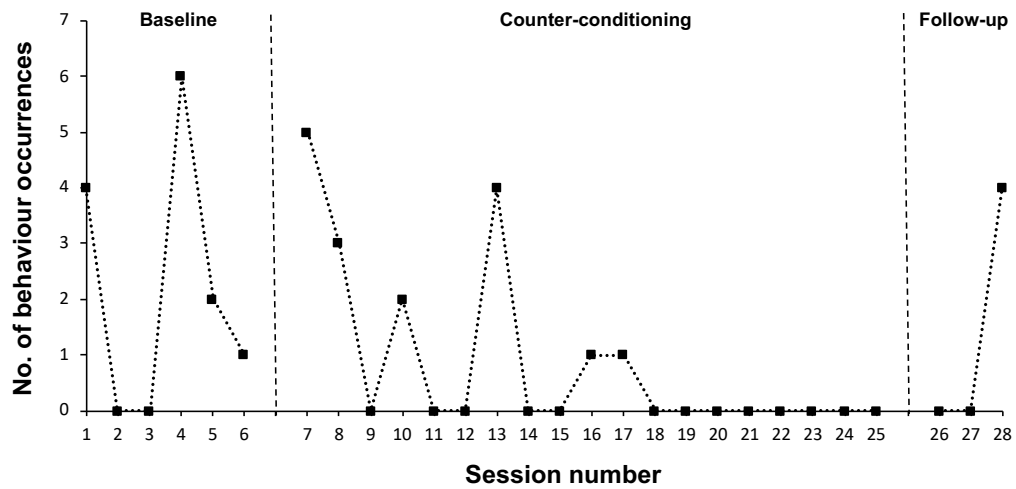


Figure 11. The number of instances of destructive behaviour that occurred during a 3600 s absence for baseline, counter-conditioning, and follow-up conditions for Dog 4.

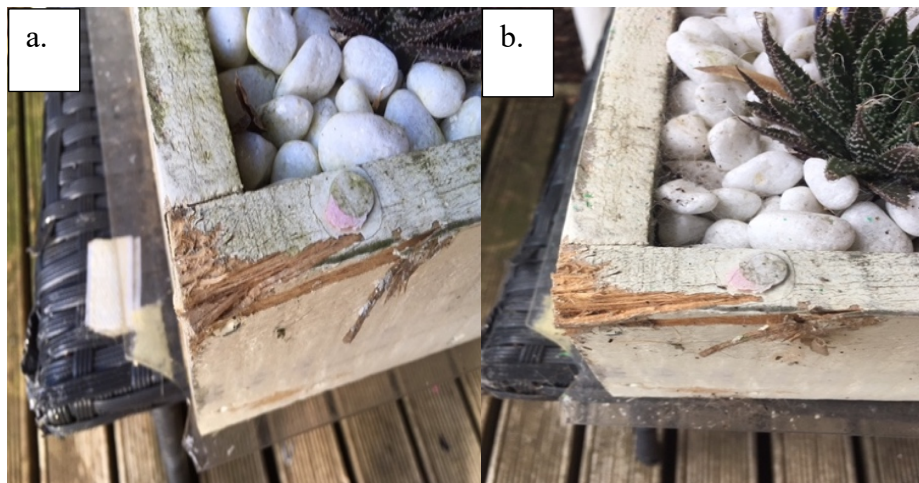


Figure 12. a) A wooden garden frame damaged during Session 1, and b) the same wooden garden frame 77 days later.

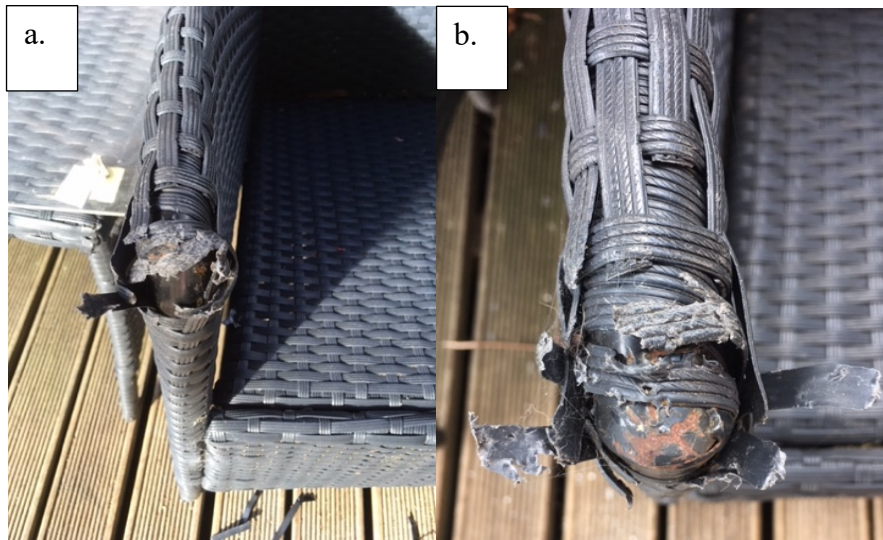


Figure 13. a) Destruction towards the arm of a chair during Session 1, and b) the same arm chair 77 days later.

Latency

Latency for Dog 4 was analysed using the same measures as Dog 1.

Destruction

As displayed in Figure 14, latency to destruction varied considerably as destructive behaviour was not always present during the baseline absences.

Latency remained low during the initial counter-conditioning sessions but as the sessions were progressively applied, latency to destruction increased until the owner's absence no longer elicited destructive behaviours. Destructive behaviours remained absent during follow-up until the third observation.

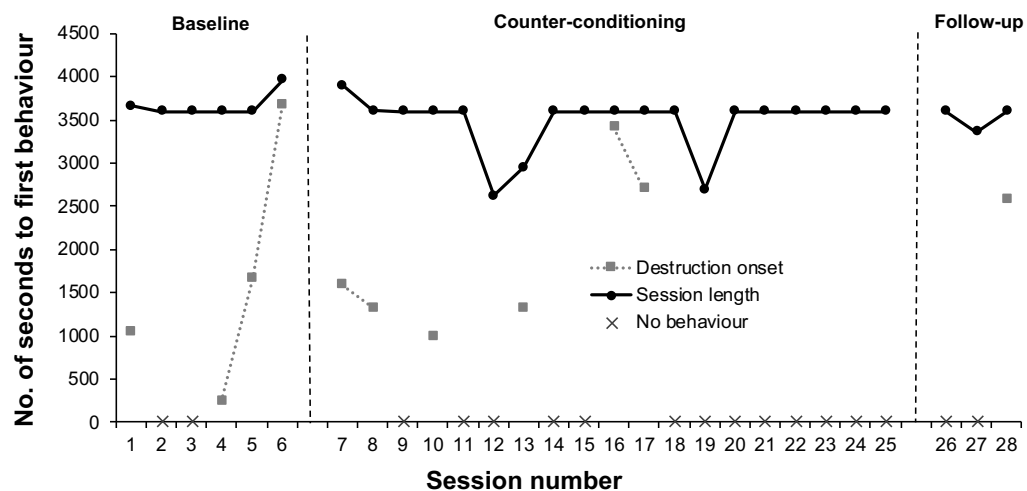


Figure 14. The time from the owner's absence to the first destructive behaviour for Dog 4, for baseline, counter-conditioning, and follow-up conditions.

Dog 5

Dog 5 engaged in vocalisation during the owner's absence which I measured using frequency and latency. Dog 5 was not exposed to counter-conditioning.

Frequency

To generate the data points for frequency, I calculated the total number of vocalisations that occurred during a 1500-s absence for baseline and follow-up conditions. For the systematic desensitization absence session, vocalisations are displayed as the number of instances per 1500-s absence.

Vocalisation

As displayed on Figure 15, the frequency of vocalisations increased substantially over the three baseline observations. The frequency of vocalisations during the first systematic desensitization absences remained within baseline levels, but as the treatment progressed vocalisations remained absent. However, frequency increased rapidly above baseline levels during one absence session before decreasing again. That sudden burst in vocalisations was not displayed

again, however, as the treatment progressed, the frequency of vocalisations increased over a few absence sessions, but the majority of the sessions displayed an absence of vocalisation. Vocalisations slowly increased back to baseline levels during the follow-up observations.

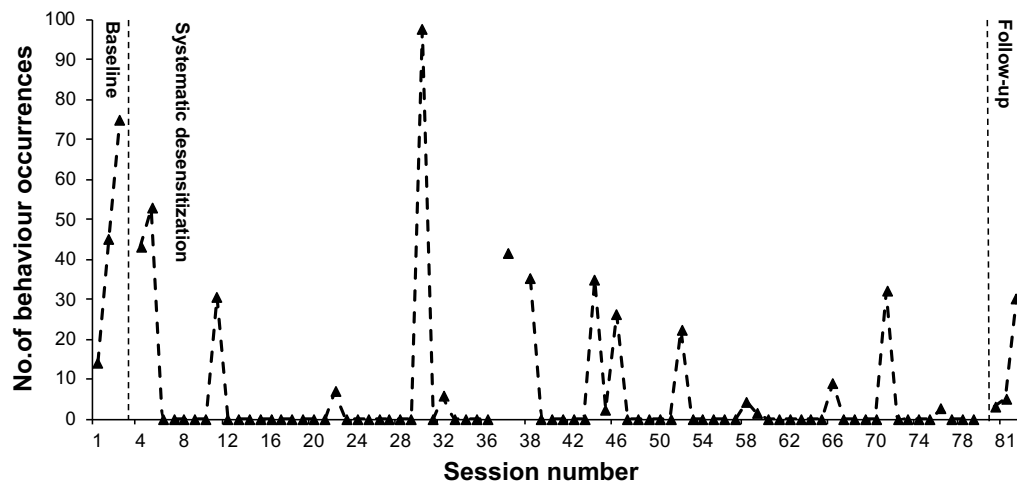


Figure 15. The number of instances of vocalisations per 1500 s during each absence session for Dog 5 over baseline, systematic desensitization, and follow-up conditions.

Latency

Latency for Dog 5 was analysed using the same measures as Dog 1.

Vocalisation

Latency to vocalisation remained consistent over the three baseline observations, as shown in Figure 16. Initial systematic desensitization absences elicited SRB, resulting in short latencies and a reduction in session lengths. However, after the session length was reduced, latency continued to gradually increase as the treatment progressed. Unfortunately, during the follow-up

observations vocalisations recurred which resulted in a reduction in latency to vocalisation. However, latency remained slightly above baseline levels.

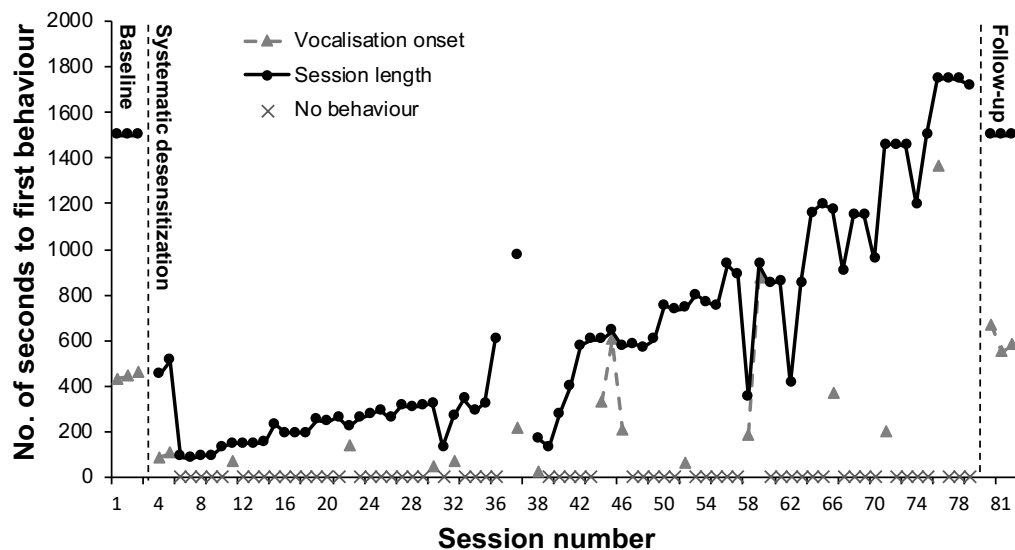


Figure 16. The time from the owner's absence to the first vocalisation exhibited by Dog 5, for baseline, systematic desensitization, and follow-up conditions.

Inter-rater agreement

The percentage of agreement between both observers for all five dogs is presented in Table 4.

Table 4
Inter-rater Agreement

		Dog 1		Dog 2	Dog 3	Dog 4	Dog 5
Inter-rater method	V	D	P	V	V	D	V
Interval Sampling	95.11%	89.03%	84.79%	90.32%	82.77%	—	—
Latency	100%	95.68%	91.22%	85.76%	98.54%	99.97%	97%
Frequency	—	—	—	—	—	100%	91.12%

Note. V = vocalisation; D = destruction; P = panting; — = data not obtained

Compliance for Systematic Desensitization

Figure 17 displays the number of absence sessions implemented each day for systematic desensitization for Dogs 1, 2, 3 and 5. Dog 4 was not exposed to systematic desensitization. For Dogs 1 and 3, the number of systematic desensitisation absence sessions declined per day as the treatment progressed. Dog

2 was exposed to four absence sessions each day the treatment was implemented. Although systematic desensitization was not implemented each day for Dog 5, the number of absence sessions implemented increased as the treatment progressed.

Summary

Overall, systematic desensitization reduced the frequency of SRB for Dog 5 without the support of other behavioural techniques. However, this effect was not seen for Dogs 1, 2 and 3 as the session length did not increase above baseline levels during treatment. Similarly, counter-conditioning only reduced SRB for Dog 4 without the support of other behavioural techniques and positive effects of counter-conditioning were not seen for the other canines who rather displayed either no change or an increase in SRB. Furthermore, previous exposure to systematic desensitization may have had an effect on the substantial reduction in SRB 14 days after counter-conditioning was implemented for Dog 3.

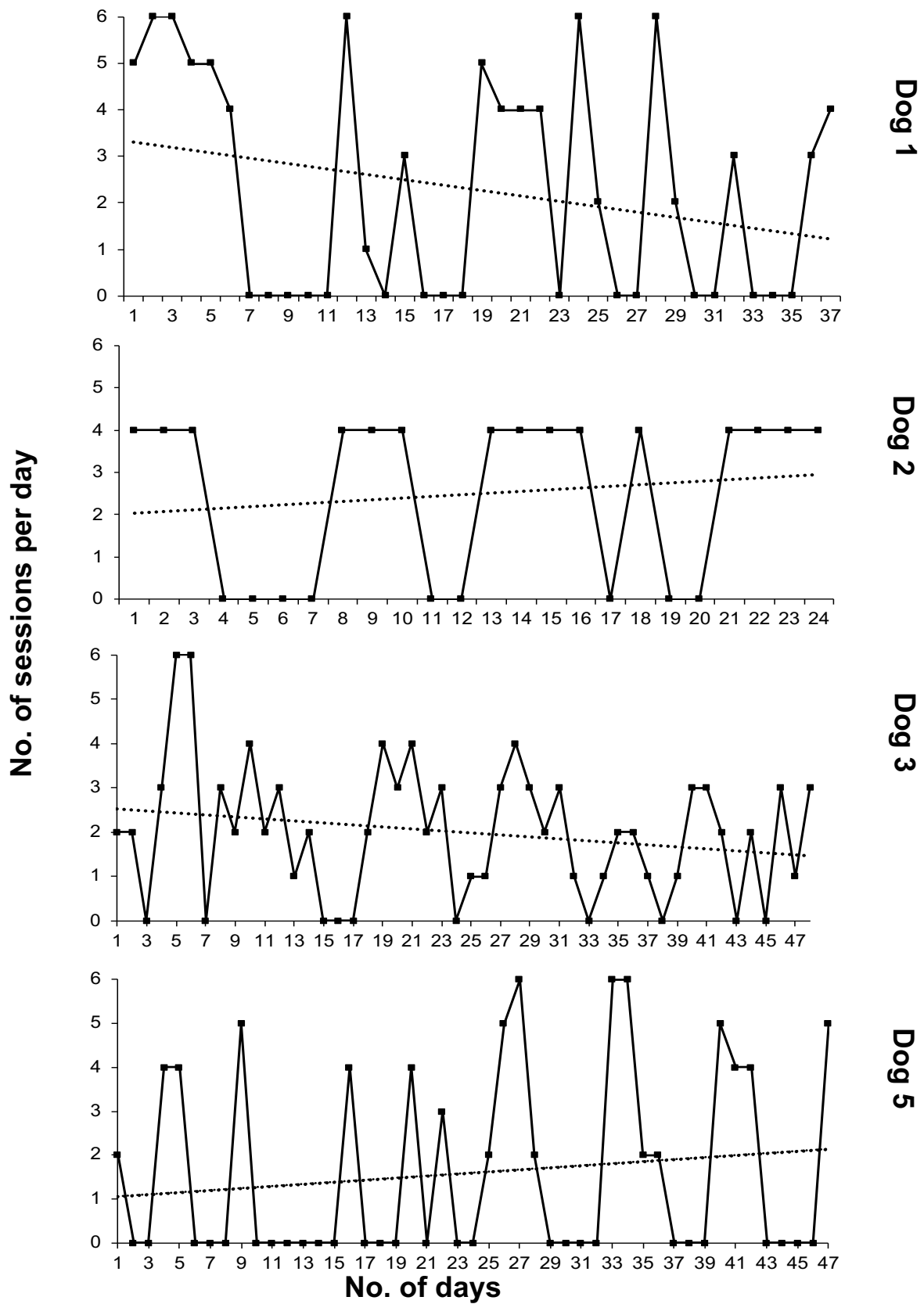


Figure 17. Number of absence sessions applied each day during systematic desensitization for all dogs except Dog 4.

Discussion

I aimed to identify whether one behavioural intervention would be effective to reduce or eliminate SRB without the support of other behavioural techniques. Overall, my results did not provide strong evidence for systematic desensitization or counter-conditioning as effective stand-alone behavioural treatments for canine SRB.

I produced minimal evidence that systematic desensitization was effective at reducing SRB, as SRB were initially reduced for Dogs 1 and 5. Additionally, panting reduced during and after treatment for Dog 1. Furthermore, I also produced minimal evidence that counter-conditioning was effective at reducing SRB, as SRB was reduced for Dog 4. A reduction in SRB was also displayed for Dog 3, 14 days after the last counter-conditioning application, but it is possible that systematic desensitization reduced the canine's distress response before counter-conditioning was implemented, suggesting that both treatments may have had an effect on reducing the distress response for Dog 3. This effect was not found with any other canine, as Dog 3 was the only canine exposed to counter-conditioning after systematic desensitization. SRB for Dog 2 remained unchanged after being exposed to both interventions separately.

Overall, the effects of systematic desensitization and counter-conditioning were not effective in the long-term for eliminating SRB, as SRB was reduced but not eliminated for Dogs 1 and 3, unchanged for Dog 2 and recurred 14 days after the last treatment for Dogs 4 and 5.

Separation-Related Behaviours

Butler et al. (2011) investigated whether a combination of behavioural techniques could reduce or eliminate SRB when owner-implemented. They

reported that systematic desensitization was responsible for almost completely eliminating SRB as opposed to the combination of treatments. In my study, SRB was only eliminated for one dog when exposed to systematic desensitization and once the treatment finished, SRB re-appeared 14 days later, providing less convincing evidence for the success of systematic desensitization in isolation. Butler et al. (2011) reported that counter-conditioning did not have an effect on the reduction of SRB, as five out of the eight owners were non-compliant with the counter-conditioning instructions. I also found that counter-conditioning was not effective at reducing SRB but rather increased the symptoms of separation-related distress.

Counter-conditioning instructions have differed between studies, with some researchers instructing owners to provide a reinforcing food treat during departure and on arrival, and others instructing owners to provide a special toy only before departure (Blackwell et al., 2016; Butler et al., 2011; Herron et al., 2014; Takeuchi et al., 2000; Thomas, 2018). Takeuchi et al. (2000) previously suggested that providing a special toy before isolation without the implementation of systematic desensitization could elicit anxiety as the toy could become associated with the owner's departure, in a classical conditioning association. Classical conditioning is where responses are elicited once a stimulus is repeatedly paired with an event (Baum, 2014). Providing the canine a reinforcing food treat is an attempt to extinguish the conditioned response by eliciting a new response that is incompatible with respondent behaviour associated with anxiety during the owners departure (Butler et al., 2011; Martin & Pear, 2010). However, the counter-conditioning sessions in the present study resulted in SRB increasing in frequency for Dogs 1 and 2. Although, counter-conditioning reduced SRB for

Dog 4, the effects of counter-conditioning may differ for each canine depending on the function of the behaviour and also other symptoms that the canine may be experiencing, such as a decreased appetite while in the anxious state (Voith & Borchelt, 1985). Counter-conditioning would not be an ideal intervention to implement if a canine had a decreased appetite during the owner's absence, as the canine might not ingest the food treat but rather leave it untouched until the owner returns home (Voith & Borchelt, 1985).

The order in which the interventions were delivered may have had an effect on the outcome, as the vocalisation frequency for Dog 3 reduced substantially during follow-up observations after this dog was exposed to counter-conditioning following systematic desensitization. The effects of systematic desensitization may have been maintained during counter-conditioning, which may have resulted in a reduction of SRB as the effects of both treatments may have worked simultaneously although they were applied individually. However, to test the hypothesis that the effects of both treatments were effective at reducing SRB, additional baseline observations should have been completed before the next intervention was implemented.

Dogs 1 and 2 were exposed to prolonged absences while systematic desensitization was being implemented. Exposure to the owner's absence at a longer duration could elicit SRB which counteracts the systematic desensitization protocol. If an owner applies long absences during systematic desensitization, the owner is implementing a procedure similar to the flooding method. Flooding is a behavioural intervention used to eliminate fears and phobias through repeatedly eliciting the fear and anxiety towards a stimulus at high intensity (De Moor, 1970). Wolpe (1996) reported that flooding may exacerbate the phobia making it

more difficult to eliminate. Previous researchers compared the effects of systematic desensitization and flooding by placing nine human subjects with snake phobia into one of three groups; flooding, systematic desensitization and a control group. Systematic desensitization and flooding were both effective at reducing fear behaviours. However 6 months after treatment, seven subjects in the flooding group relapsed, with four subjects presenting exacerbated behaviours at the follow-up test (De Moor, 1970).

I found that when I implemented systematic desensitization for Dog 5 there was no change on the outcome of the treatment as SRB consistently reduced when compared to owner implementation. In agreement with my findings, Echterling-Savage et al. (2015) reported that owner-implemented interventions are less effective than researcher implemented interventions. The lack of attachment the canine had with the researcher and the difference in departure routine during the absence sessions may explain why Dog 5 exhibited a recurrence of SRB during the follow-up observations. The follow-up observations applied by the owner then exposed the canine to the owner's regular departure cues that were not presented during the treatment.

The respondent elicitation functions of the cues are reduced by implementing systematic desensitization absences. However, if the owner engages in a departure routine differing from their normal routine such as walking or biking rather than driving, the new cues may not elicit the distress response as they have not been previously associated with the owner's departure. For example, if the owner applied the absence sessions by walking and no SRB were elicited, the owner may conclude that the SRB have been eliminated, until cues associated with the owner's normal departure routine elicit a distress response.

Systematic desensitization needs to be applied in a real-world setting. I found that certain stimuli present during treatment continued to elicit a response for Dogs 2 and 3. Applying systematic desensitization with the support of additional behavioural techniques such as de-coupling cues may be beneficial to help further reduce the elicitation of SRB.

SRB continued to reduce even when treatment was not applied on consecutive days, as vocalisations reduced for Dog 5 who was exposed to systematic desensitization over 19 non-consecutive days. However, vocalisations did reoccur during follow-up, suggesting that the canine should have been exposed to additional systematic desensitization absences longer than 29 min. Previous authors have suggested that SRB are usually eliminated once the owner has reached 30-to-90-min absences without recurrence of SRB (Borchelt & Voith, 1982; Butler et al., 2011), but this was not supported by my findings. The number of treatment days could have been a factor in the recurrence of SRB, as Orihel and Fraser (2008) found that applying systematic desensitization and counter-conditioning for 10 days for canines that exhibited inter-dog aggression was not effective at reducing behaviours. The authors suggested that continuing treatment over a longer period may have maintained the behaviour reduction. In the present study, time was one particular barrier for systematic desensitization for owners of Dogs 2 and 5 because of their employment. If the owner could not find the time to implement the systematic desensitization absences then the treatment would be irrelevant and as a consequence the canine continues to be at risk of being removed, relinquished or euthanised. Furthermore, owners may choose an alternative solution such as doggy day-care or a pharmaceutical intervention, as the owner may require SRB to be reduced immediately rather than reducing SRB

over a period of time with a behavioural intervention. However, pharmaceuticals do not address the function of behaviour but rather suppress the behaviours (Podberscek et al., 1999) and pharmaceuticals would not be a long-term solution as behaviours may still occur when the medication is no longer prescribed, plus owners may not desire to continuously pay for medication due to the cost (Podberscek et al., 1999).

My inclusion criteria were comparable to those of six other studies (Butler et al., 2011; Cannas et al., 2014; Flannigan & Dodman, 2001; Palestrini et al., 2010; Podberscek et al., 1999; Simpson et al., 2007) but differ from King, J. N. et al. (2000) who also required canines to display three additional behavioural signs in order to be considered for recruitment, such as following the owner in the house, distress when the owner prepared to leave and “excessive greeting”. Hyper-salivation and vomiting have also been included in previous research that has assessed the effect of behavioural modification techniques alongside clomipramine (Podberscek et al., 1999; Simpson et al., 2007). Differences in inclusion criteria could explain the different results found by previous researchers, as well as the different behavioural management techniques to help reduce SRB, as some researchers advised owners to cease punishment and to provide attention only at the owner’s initiative. Other behavioural techniques include providing no attention for 30 min before leaving home, providing the canine an item imprinted with the owner’s scent, and practicing leaving routines without leaving the house (Blackwell et al., 2016; Herron et al., 2014; King, J. N. et al., 2000; Podberscek et al., 1999; Simpson et al., 2007; Thomas, 2018).

King, J. N. et al. (2000) instructed owners to implement a behavioural plan in combination with an assigned dosage of clomipramine and found that SRB

reduced significantly alongside clomipramine at a dosage of 1 to <2mg/kg, PO, q. 12 h compared to those canines who received the placebo with behavioural treatment. In addition, it was also reported that destructive behaviours increased by 12% after 84 days for canines in the placebo group, with only 31% (n=8) of canines having improved or eliminated destructive behaviours. I found similar results, as Dog 1 did not display any improvements in destructive behaviour but rather displayed an increase in frequency during the systematic desensitization absences. Conversely, Podberscek et al. (1999) did not find SRB to increase when behavioural modification techniques were used. Although, the behavioural techniques provided to owners differed among my study, King, J. N. et al. (2000) and Podberscek et al. (1999).

In line with previous findings (Blackwell et al., 2016; Cannas et al., 2014; Lund & Jørgensen, 1999; Palestrini et al., 2010; Thomas, 2018), vocalisation was the most frequently reported behaviour by my owners. Each dog exhibited various vocalisations, with some canines mixing different types of vocalisation (Figure 2) (Lund & Jørgensen, 1999; Palestrini et al., 2010). An alternative vocalisation was also exhibited by Dog 3, which I labelled as a low-magnitude vocalisation that can be verbally described as heavy breathing with a slight whine as the canine exhaled (Figure 2). The increased frequency of these low-magnitude vocalisations suggests that the intensity of separation-related distress experienced by the canine reduced as these vocalisations increased in frequency as the owner's absence increased. However, to confirm that the interventions also have an effect on the reduction of volume, further research should also include analysing the hertz of vocalisations.

All canines in my research, except for Dog 4, engaged in SRB on every occasion that they were isolated, unlike Blackwell et al. (2016) who reported that only 25% of dogs that showed SRB did so on every occasion they were isolated. Furthermore, in agreement with previous findings I found that SRB occurred within 30 mins of the owner's departure for all five dogs (Blackwell et al., 2016; Takeuchi et al., 2000), peaking within the first hour of the owners departure and reducing in frequency as the owner's absence increased, with an average latency of 3 min for all five dogs (Lund & Jørgensen, 1999; Palestrini et al., 2010). Vocalisations were found to decrease 35 min after the owner's absence for Dogs 2 and 5, however, vocalisations for Dogs 1 and 3 were consistent for over 60 min but Dog 1 continuously vocalised for over 2 hours, which rarely occurs with SA (Voith & Borchelt, 1985). Confinement in a crate for Dog 1 could have been a factor contributing to SRB occurring consistently at a high intensity after 60 min of isolation and continued to increase during systematic desensitization, as isolation within a crate has previously been suggested to increase a discomfort response rather than alleviate anxiety (Palestrini et al., 2010; Voith & Borchelt, 1985).

Dogs 1 and 3 were isolated for less than 2 hours a week and exhibited more frequent high-intensity SRB (Kobelt et al., 2003) compared to Dogs 2, 4 and 5 who were isolated for 8 hours a day and exhibited lower frequency SRB. In agreement with my results, Thomas (2018) also reported that greyhounds who were isolated for more than 4 hours were less likely to exhibit SRB. Whereas other researchers have not discovered an association between the number of hours the canine is isolated per day and the occurrence of SRB (Blackwell et al., 2016; Herron et al., 2014).

Flint (2012) reported that 41% of canines adopted as adults from rescue shelters were likely to show SA (Flannigan & Dodman, 2001) although, high reports of SA in canines adopted from shelters may be due to the canine being relinquished to the shelter due to SRB (Blackwell et al., 2008). In contrast, Palestrini et al. (2010) reported that 31.2% of canines that exhibited SRB were re-homed from another person (Blackwell et al., 2016), 25% of dogs were acquired from a rescue shelter, and 12.5% of canines were adopted from a breeder. Comparable to Palestrini et al. (2010), three of the five canines recruited in my research were re-homed due to previous owners not wanting the canine. SA has been suggested to develop with canines that have had several owners, traumatic separation, changes in the owners routine, or exposure to prolonged periods of confinement (Schwartz, 2003; Takeuchi et al., 2000). Dog 1 had been re-homed twice before his current owner and had had surgery to remove cancer when the behaviours began to occur, and Dogs 2 and 5 had experienced changes to their daily routine when behaviours began to occur. The owners of Dogs 3 and 4 did not report any specific events to explain why SRB may have occurred but rather that the behaviours began after the dog was acquired.

Benefits of Video Recordings

Owner reports have been commonly used by researchers to gather previous history on behaviours and information regarding the present behaviours (Butler et al., 2011; Blackwell et al., 2016; Thomas, 2018). Although owner reports are crucial (Takeuchi et al., 2000), owners can be unreliable (Konok, Dóka, & Miklósi, 2011) as they can report non-existent behaviours or under-report behaviours. For instance, whining, pacing or trembling would not be detected without the use of a video camera due to the lack of evidence produced.

Previous studies have identified pacing and trembling occurring during the owners absence (Palestrini et al., 2010), whereas other researchers who did not utilise video cameras, did not report such behaviours (Butler et al., 2011). Cannas et al. (2014) monitored the progress of SRB by video recording the 7th, 14th, 28th and 56th day of treatment, measuring the frequency and duration of the behaviours elicited for the first 30 mins of the owner's absence. During baseline, Cannas et al. (2014) reported that 65.2% (n=11) of canines exhibited panting as the owner prepared to depart. I found that Dog 1 exhibited panting with an average latency of 19.67 min during baseline, with panting increasing in intensity as the owner's absence increased. It has been previously suggested that increases in panting could be due to exhaustion rather than a distress response (Palestrini et al., 2010), however, I found that the frequency of panting reduced and the latency to panting increased to 29.1 min during follow-up for Dog 1 after the dog was exposed to systematic desensitization. My findings produced some evidence that the independent use of systematic desensitization is practical for reducing the less obvious signs of separation-related distress that do not produce adequate evidence.

The use of a video camera enabled me to eliminate dogs as subjects in cases where the owner-reported behaviour was not a distress response related to the owner's absence but rather to external stimuli. Neighbours can frequently report to owners when excessive vocalisation occurs. However, Flint (2012) suggested that neighbours may complain about vocalisations because of beliefs around dog attacks as well as the annoyance and daily disruption of the vocalisations.

I designed the methodology to produce more reliable and accurate information by observing the canine's behaviours rather than relying on owner

and neighbour reports as measures. By observing the canine's behaviours via video camera, measures such as latency and frequency could be used until the end of treatment, therefore eliminating the possibility of owners miss-reporting or over-reporting behaviours. In addition to video recording, providing owners with a questionnaire that asks owners to self-report on the improvement of SRB and efficacy of the behavioural intervention in future research could help compare the differences of owner reports and measuring behaviour via video analysis. This comparison could provide evidence that using video cameras to observe SRB is highly important as the owner cannot observe the occurrence of SRB as SRB, by definition, only occurs in the absence of the owner.

Functional analysis

A functional analysis investigates what maintains the behaviour by examining the possible consequences (Borchelt & Voith, 1982; Dorey, Tobias, Udell, & Wynne, 2012) and previous researchers have mentioned that separation-related disorders could be the consequence of underlying states such as discomfort, fear, or other anxiety-related disorders (Appleby & Pluijmakers, 2004; Palestrini et al., 2010). A functional analysis can be useful for identifying how to treat a behaviour problem because behaviours occur for different reasons (Borchelt & Voith, 1982). For example, excessive vocalisation during the owner's absence may be positively reinforced by the owner's return or negatively reinforced by allowing the canine to accompany the owner on the outing. Automatic reinforcement may be another explanation for excessive vocalisation or chewing during the owner's absence, as the isolation environment may not produce enough stimulation for the canine so behaviours such as barking, or chewing may occur to elicit stimulation, producing self-reinforcement.

Completing a functional analysis before implementing treatment would have been beneficial to provide a better understanding of the factors that are responsible for the SRB, enabling the researcher and owner to select the most appropriate intervention. For example, the function of behaviour for Dog 2, may be due to vocalisations being reinforced by the dog being allowed to accompany the owner, as previously, accompanying the owner has led to access to walks, socialization with other dogs, and doggy day-care, therefore functioning as a powerful conditioned reinforcer.

Completing a functional analysis before owners relinquish their canine would also be beneficial, as then the owners would have information that would help new owners determine why the unwanted behaviour is occurring and what interventions would be suitable.

Compliance

In agreement with previous studies, owners were more likely to comply with baseline, counter-conditioning and follow-up conditions, rather than systematic desensitization, as owners reduced the number of absence sessions they were applying daily as the treatment progressed (Blackwell et al., 2016; Butler et al., 2011). The reduction in compliance during systematic desensitization resulted in an increase in, or no effect on SRB, compared to when owners consistently complied with the treatment instructions. Likewise, Thomas (2018) reported that dogs belonging to owners with higher compliance scores were more likely to have low SA scores compared to dogs belonging to owners with low compliance scores. However, Takeuchi et al. (2000) reported that treatment compliance was not associated with the reduction in SRB. In contrast, Butler et al. (2011) reported that owners were incompliant with counter-conditioning instructions and

compliant with systematic desensitization. In my study, systematic desensitization was an impractical intervention for some owners. Three owners who were randomly assigned to Group A after baseline removed themselves from my research (Appendix B) during the beginning of systematic desensitization as they could not comply to the requirements of the intervention, suggesting that systematic desensitization is more difficult to implement in everyday life.

Owners also became less compliant with uploading the video recordings of the systematic desensitization absence sessions. Owners were instructed to upload each absence video after completion so that a decision could be made on whether to increase or decrease the time of the absence session. Two owners did not comply with these instructions and uploaded all the videos together after the absence sessions had been completed for the day or had uploaded the videos 1-to-2 days after the absence sessions were conducted. Due to the delay in receiving the videos, the sessions were not reduced as they ought to have been.

Limitations and Future Research

Due to the fixed location of the video camera, vocalisations and destructive behaviours may have been over-or under reported. For example, Dog 4 disappeared from the sight of the video camera many times during the 60-min absence and may have engaged in destructive behaviours while out of the scope of the video camera. Assumptions were also made about when the owner departed based on the sound of a door shutting.

The audio programme ‘Audacity’ was not reliably tested to ensure the frequency of vocalisations were measured accurately. This could have affected the frequency of vocalisations as it may not have reflected an accurate number of vocalisations measured during an absence session. Furthermore, ‘Audacity’ did

not measure the sound waves from the low-magnitude vocalisations exhibited by Dog 3, increasing the difficulty of defining the vocalisation and reporting it. If an appropriate programme that accurately measures canine vocalisations was used, the results for Dog 3 may have been presented differently as the low-magnitude vocalisations may have been considered as breathing rather than a vocalisation.

Previous researchers have investigated many different combinations of behavioural techniques and found different results (Blackwell et al., 2016; Butler et al., 2011; Herron et al., 2014; Simpson et al., 2007; Takeuchi et al., 2000), leaving the question of, what behavioural techniques are effective at reducing SRB for canines, unanswered for owners. Further investigation into the effects of combining systematic desensitization and counter-conditioning compared with other combinations of behavioural techniques such as extra exercise and decoupling cues would be beneficial. A questionnaire would also be valuable for examining the owner's opinion on the outcome of the treatment even if behaviours were not eliminated, as a reduction in SRB may still be valuable for the owner.

Conclusion

Implementing systematic desensitization or counter-conditioning independently without the support of other behavioural techniques did not reduce or eliminate the long-term SRB of canines. Although the independent application of both interventions reduced SRB for one canine during and after treatment, both canines exhibited a recurrence of SRB at baseline levels during the third follow-up observation. My results do not support my hypothesis, nor do they align with previous findings that suggested systematic desensitization was effective at reducing and eliminating SRB when implemented as an individual intervention

(Butler et al., 2011). Rather, my results rather suggest that the requirements of systematic desensitization alone are not adequate to eliminate SRB and the support of other behavioural techniques is required. Factors associated with the reduction of SRB during systematic desensitization for Dog 5 include owner compliance and the avoidance of prolonged absences while systematic desensitization was being implemented. The incompletion of systematic desensitization also suggests that the treatment is unrealistic for some owners to implement. However, due to the small sample, more research is recommended before conclusions can be drawn about the effectiveness of systematic desensitization and counter-conditioning as independent interventions, and further investigation into the independent effects of systematic desensitization needs to be completed with a larger sample.

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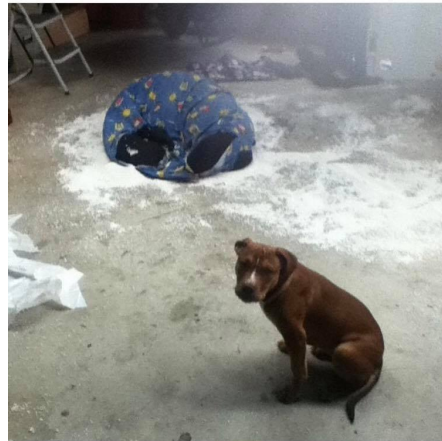
Appendix A: Recruitment Flyer

Is your dog missing you?

Are your neighbours complaining of excessive barking while you are absent from home? Are you coming home to a pile of destruction? WE WANT YOUR DOG!

A current Master's research student is looking to recruit dogs with behavioural problems that may occur due to separation-anxiety.

I aim to observe problematic behaviours of dogs and assess the efficacy of a behavioural treatment that will be administered by the owner (no medication or devices will be used on the dog).



This Master's project involves the owner to administer the behavioural treatment, as well as being in regular contact with the researcher including scheduled house visits.

This project has gained ethics approval from the University of Waikato.

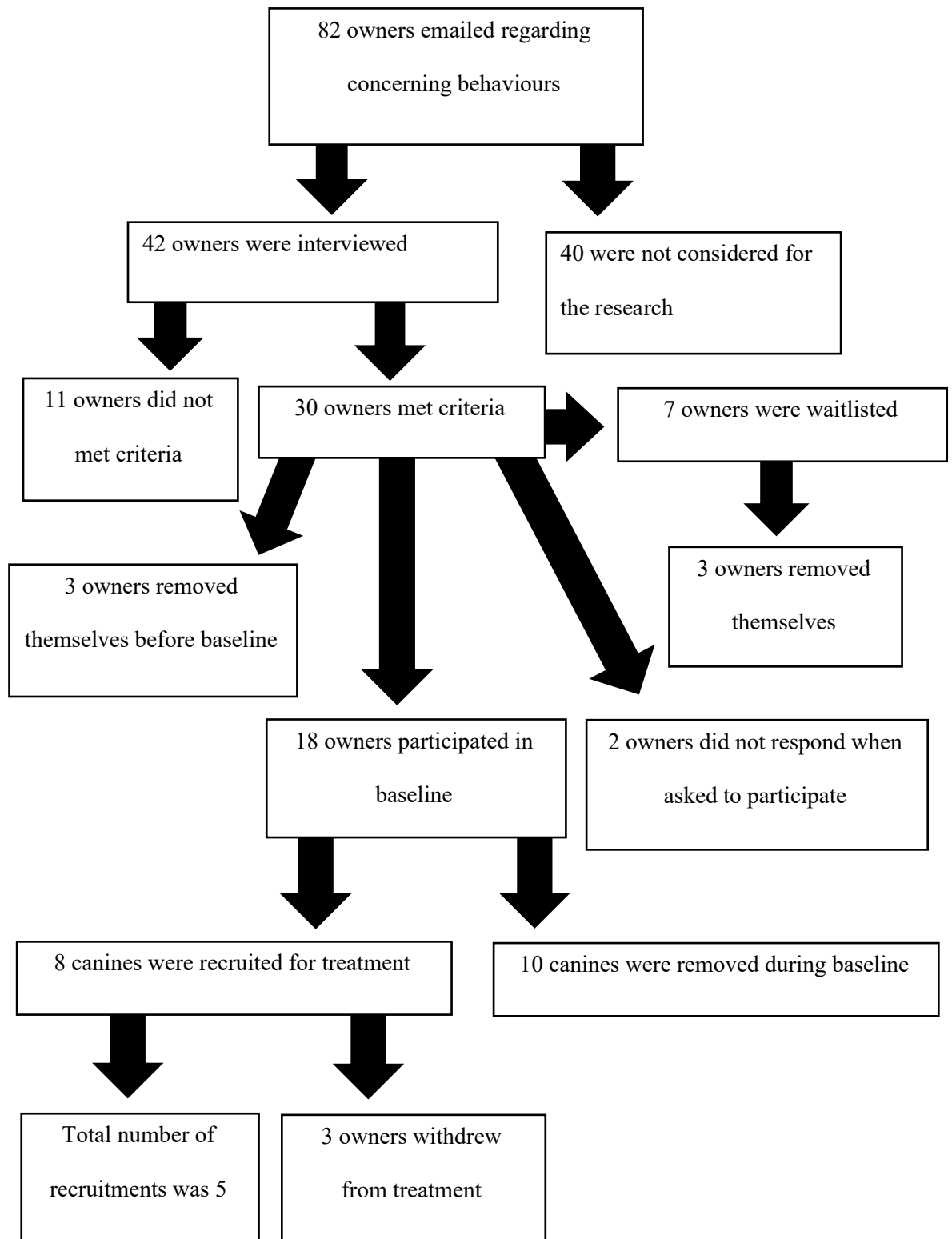
If you would like to be considered for this research project or have any further questions, please email Ocean Babington on:

oceanbabington@gmail.com

Research supervisors:

Rebecca Sargisson: rebecca.sargisson@waikato.ac.nz

Clare Browne: clare.browne@waikato.ac.nz

Appendix B: Owners Removed and Recruited

Appendix C: Screening Questions

Owner name:

Dog name:

Breed of dog:

Age of dog:

Based:

Thank you for your interest in this research.

Separation-related behaviours can cause significant stress on the canine and the owner. The severity of separation-related problem behaviours can differ for each dog, with each dog also showing different symptoms.

The following questions will help us learn what behaviours are occurring, the severity of the symptoms, and when these behaviours are occurring.

Please answer these questions honestly and to the best of your ability.

By answering these questions below, you are not a participant in the study. The information you provide us below will help us find dogs that are suitable to participate by meeting our criteria. Once these questions have been answered, you will be contacted and informed whether your dog will be recruited for the initial stage (observation/baseline), or if they are not suitable for this research. Based on the observations, we will decide whether your dog is suitable to continue in the research.

These screening questions have been adapted from research conducted by Herron et al. (2014) and King, J. N. et al. (2000).

1. Where is he/she kept primarily kept?

2. Where is he/she kept when you are absent from home?

3. Has your dog been to the vet in the past month?

Yes

No

4. Have you received any medical diagnoses from a veterinarian?

Yes

No

a. If so, what is it?

5. Approximately, how many hours is your dog left home alone on a typical weekday?

6. How many days per week, on average, do you leave your dog home alone?

7. How needy/clingy is your dog when you are home?

- a. Very needy/clingy
- b. Moderately needy/clingy
- c. Slightly needy/clingy
- d. Not needy

8. How often does your dog destroy, furniture, clothing, shoes, crate bedding or other household items when he/she is left home alone?

- a. Never
- b. At least 25% of the time
- c. At least 50% of the time
- d. At least 75% of the time
- e. Every time

9. How bad is the destruction?

- a. No destruction
- b. Standard
- c. Bad
- d. Very bad

10. Where is this destruction occurring?

- a. Outside
 - b. Door framings?
 - c. Curtains?
 - d. Anywhere else?
-

11. Does he/she engage in destructive behaviours while you are at home?

Yes No

12. How often does your dog urinate or have a bowel movement in the house or crate when he/she is left home alone?

- a. Never
- b. At least 25% of the time
- c. At least 50% of the time
- d. At least 75% of the time
- e. Every time

13. If your dog urinates or defecates inappropriately, where in your home does your dog do this?

14. Does he/she urinate or defecate inappropriately in the house when you are home?

Yes

No

15. How often do you suspect or hear reports that your dog is barking or whining while he/she is left home alone?

- a. Never
- b. At least 25% of the time
- c. At least 50% of the time
- d. At least 75% of the time
- e. Every time

16. Does he/she bark excessively when you are home?

Yes

No

17. If your dog is sometimes kept in a crate, how often does your dog escape his/her crate or cause damage to the crate in attempts to escape when left home alone?

- a. Not Applicable
- b. Never
- c. At least 25% of the time
- d. At least 50% of the time
- e. At least 75% of the time
- f. Every time

18. Does your dog attempt to escape the crate while you are home?

Yes

No

19. Does your dog become distressed when you prepare to leave home?

Yes

No

20. Which of the following options best fits your dog's behaviour as you prepare to leave the house?

- a. Indifferent
- b. Calm and content
- c. Sad, but quiet

- d. Nervous: some trembling, seems mildly distress
- e. Panicked: pacing, blocking your exit, and/or vocalizing

Appendix D: Information Sheet and Consent Form

Information sheet

Hi, my name is Ocean and I am a current master's thesis student who is studying Psychology at the University of Waikato. For my master's thesis, I aim to observe dogs that display separation anxiety and compare the efficacy of two behavioural treatments, when used separately, to help reduce behaviours that may be occurring due to separation anxiety.

For this research project, the time frame of the study will differ between participants. During the observation phase, participants are required to turn on and off a video camera each time they leave their dog alone. The observation phase should take between 1-2 weeks and once the behaviours of the dog occurs consistently at a steady rate, the behavioural treatments will be applied. The owners are expected to apply the appropriate behavioural treatment to their dog. The application of the counter-conditioning treatment should take no longer than 2-5 minutes a day, and the application of systematic desensitization will increase as the treatment progresses. As the owner will need to be absent from home starting at 10 minutes and increasing to an absence of two hours (Both behavioural treatments are very simple and easy to apply). The administration of the behavioural treatments should take between 3-5 weeks.

As a participant in this study, you will be asked to:

- Turn a video camera on and off when required
- Apply a behavioural treatment when requested
- Contact the researcher if any issues arise or you have any concerns
- Keep in regular contact with the researcher

You will administer the behavioural treatments in your home. You will be provided information about the behavioural treatments that will be implemented and provided instructions on how to administer the treatments in person by me. None of the behavioural treatments in this research project involve punishment or harm of any kind to your dog.

You are allowed to withdraw from the research for any reason without penalty. If you would like to withdraw your data from the research for any reason, you will be able to withdraw your data up to 2 weeks after the completion of your participation. After that stage, it will be difficult to remove any data, as all data would have been subjected to analysis. All dogs will remain anonymous, and no identifying details will be provided to anyone outside of this project. Any identifying details of the owners will not be mentioned in the thesis. Once the research has been finalised, participants can request the results or request a meeting to discuss the results that were found. This research has received both animal and human research ethics from the University of Waikato Animal Ethics Committee and the School of Psychology Research and Ethics Committee. If you have any further questions, or are concerned about any issues that may arise, please do not hesitate to contact me via email: oceanbabington@gmail.com

Research supervisors:

Rebecca Sargisson: rebecca.sargisson@waikato.ac.nz

Clare Browne: clare.browne@waikato.ac.nz

**CONSENT FORM**

A completed copy of this form should be retained by both the researcher and the participant.

Research Project: Addressing Canine Separation Anxiety Using Systematic Desensitization and Counter-conditioning

Please complete the following checklist. Tick (✓) the appropriate box for each point.	YES	NO
1. I have read the Participant Information Sheet (or it has been read to me) and I understand it.		
2. I have been given sufficient time to consider whether or not to participate in this study		
3. I am satisfied with the answers I have been given regarding the study and I have a copy of this consent form and information sheet		
4. I understand that taking part in this study is voluntary (my choice) and that I may withdraw from the study at any time without penalty		
5. I have the right to decline to participate in any part of the research activity		
6. I know who to contact if I have any questions about the study in general.		
7. I understand that the information supplied by me could be used in future academic publications.		
8. I understand that I have two weeks to withdraw my data from the research after my participation. After that stage it will be difficult to remove any data, as all data would have been subjected to analysis		
9. I understand that my participation in this study is confidential and that no material, which could identify me personally, will be used in any reports on this study.		
10. I wish to receive a copy of the findings		

Declaration by participant:

I agree to participate in this research project and I understand that I may withdraw at any time. If I have any concerns about this project, I may contact the convenor of the Psychology Research and Ethics Committee (Dr Jaimie Veale, phone 07 837 9580, email: jveale@waikato.ac.nz)

Participant's name (Please print): _____

Signature: _____

Date: _____

Declaration by member of research team:

I have given a verbal explanation of the research project to the participant, and have answered the participant's questions about it. I believe that the participant understands the study and has given informed consent to participate.

Researcher's name (Please print): _____

Signature: _____

Date: _____

Appendix E: Video Camera Instructions

Instructions for the video camera

- Please turn the camera on when you leave your dog home alone. When you arrive home, turn the video camera off.
- Your video camera has 5 hours and 43 minutes of continuous recording time.
- Please make sure that your video camera is fully charged each day or leave it on charge when recording.
 - The video camera will record for two hours on a fully charged battery pack.
- **To turn the video camera on**, open the screen, and push the on/off button on the side of the video camera.
- **To start recording**, slide the button at the rear of the video camera to the camera icon, then push the button with the red dot (this button is located to the right of the video camera under the recording/picture slide button)
- **To charge the video camera**, open the screen, and place the right end of the charger into the socket on the video camera.
- **To remove the SD card**, turn the video camera upside down and find the SD card port. Open that SD card port and push the SD card in and it should pop out.
- **Placing the SD card back**, turn the video camera upside down and find the SD card port. Open that SD card port, push the SD card back in.
- **When should you send your video through?**

- Please try and send the collected footage through via Google Drive **every day**. This is so the researcher can observe the behaviours that are occurring, and alter the treatment if need be.
- When you are removing the SD card from your computer, please eject the SD drive to decrease the risk of corrupting the SD card.
- **Sending your videos:**
 - Please send the videos using Google Drive.
 - You should already be shared to a Google Drive folder. On this Google Drive folder, there should be other folders; Observation phase, Treatment phase.
 - In these folders, please label the videos with the date and video number. For example, 12/04/18; video 1, 14/05/18; video 13.

Appendix F: Instructions for Systematic Desensitization

Systematic Desensitization

Systematic desensitization aims to de-sensitize the dog to the owner's absence. Systematic desensitization involves the repetition of a stimulus. This stimulus is the owner's absence to their dog. Therefore, if owners initially start with small periods of absence and increase the absence periods, the dog should start to become de-sensitized to the owner's absence. If the dog is exposed to a long period of absence continuously, de-sensitization will not occur.

You are asked to leave your dog alone for initially short periods of time and to gradually increase your absence from your dog in 5-minute increments. Owners need to increase their absence for 5 minutes until a period of 60 minutes is reached without the dog eliciting anxiety. Each time you leave your dog home alone, your absence should not elicit anxiety or the separation-related behaviours. However, if your absence does elicit anxiety or the separation-related behaviours, your period of absence will need to be decreased. Please contact me if you need advice on absence length.

Absence is defined as the removal of human presence from the property. The owner needs to remove themselves and others from the property, leaving the canine alone. The owner should not be visible to the property. The owner should not wait outside the front door, in the garage, or by the letter box.

Guidelines for Systematic Desensitization

1. Please leave your dog alone for a period of 5 minutes. This 5-minute absence should occur 4 times a day for 2 days.

2. After 2 days of exposing your dog to 5-minute absences, if no separation-related behaviours occurred, increase your period of absence to 10 minutes, 4 times a day for 2 days.
 - a. **If separation-related behaviours occur, please inform Ocean and refer back to the previous absence that did not elicit separation-related behaviours.**
3. Increase your period of absence to 15 minutes, 4 times a day for 2 days, if no separation-related behaviours occurred during the 10-minute absences.
 - a. **If separation-related behaviours occur, please inform Ocean and refer back to the previous absence that did not elicit separation-related behaviours.**
4. Increase your period of absence to 20 minutes, 4 times a day for 2 days, if no separation-related behaviours occurred during the 15-minute absences.
 - a. **If separation-related behaviours occur, please inform Ocean and refer back to the previous absence that did not elicit separation-related behaviours.**
5. Increase your period of absence to 30 minutes, 4 times a day for 2 days, if no separation-related behaviours occurred during the 20-minute absences.
 - a. **If separation-related behaviours occur, please inform Ocean and refer back to the previous absence that did not elicit separation-related behaviours.**
6. Increase your period of absence to 40 minutes, 4 times a day for 2 days, if no separation-related behaviours occurred during the 30-minute absences.

- a. If separation-related behaviours occur, please inform Ocean and refer back to the previous absence that did not elicit separation-related behaviours.**
7. Increase your period of absence to 50 minutes, 4 times a day for 2 days, if no separation-related behaviours occurred during the 40-minute absences.
 - a. If separation-related behaviours occur, please inform Ocean and refer back to the previous absence that did not elicit separation-related behaviours.**
8. Increase your period of absence to 60 minutes, 4 times a day for 2 days, if no separation-related behaviours occurred during the 50-minute absences.
 - a. If separation-related behaviours occur, please inform Ocean and refer back to the previous absence that did not elicit separation-related behaviours.**
9. Once you have reached a period of 60 minutes and your dog is not engaging in separation-related behaviours, the periods of owner absence can be increased more quickly. For example, after 60 minutes, you can increase your absence to 80 minutes (time absences will need to be discussed with the researcher).

These periods of absence from the dog do not have to be sequential. They can occur throughout the day. For example, you can do two sets of 5 minutes in the morning and two sets of 5 minutes in the afternoon and night time. Previous research recommends that the time intervals between each absence should be short but spaced out to maintain low levels of anxiety.

Owners are asked to:

- Each time you aim to leave your dog alone, please engage in your normal pre-departure activities, such as grabbing your handbag, putting your shoes on, locking up the house, locking the door, walking off the property or drive away
- Leave your dog alone when you are administering the treatment. In other words, if you plan to leave your dog, please follow through with that plan.
- Avoid punishing your dog for any reason.
- You are advised to avoid lengthy separations outside treatment protocol as much as possible.
 - o If you have work and cannot avoid long periods of absence, we may suggest:
 - Doggy day-care,
 - Having a someone be at home with your dog,
 - Taking your dog to someone's house,
 - Ocean may also be able to stay at your house with your dog

** The steps above are a guideline. The time absences may need to be altered to your dog, so sending through the footage each day is very important, so we can observe what behaviours are occurring. We may also need to decrease the time absence if the behaviours are occurring in your absence.

Appendix G: Instructions for Counter-Conditioning

Counter-conditioning

Counter-conditioning is a behavioural technique that aims to modify behaviour through replacing anxiety with a new response. Counter-conditioning has been found to help decrease separation-related behaviours in canines through presentations of a positive stimulus to the canine when the owner prepares to leave. The presentation of a positive stimulus, such as a food treat, to the dog aims to elicit positive feelings in the dog rather than negative feelings when the owner prepares to leave.

Absence is defined as the removal of human presence from the property. The owner needs to remove themselves and others from the property, leaving the canine alone. The owner should not be visible to the property. The owner should not wait outside the front door, in the garage, or by the letter box.

Instructions for counter-conditioning

1. 5 minutes before leaving the house, give your dog a treat.
2. As you are about to leave the property and your dog, give your dog another treat.
3. No punishment should be delivered to the dog during this treatment phase.
4. Please try and leave your dog home alone at least once a day.